

Research Article

The Role of Germany, the United States, and Europe in Shaping Technology Policy and World Order

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Abstract

This paper examines the technological influence of powerful economies exemplified by Germany, the United States and Europe in the shaping technology policy across the globe. These regions have emerged as critical players in establishing norms, standards, and policies that govern technology use and innovation with the rise of digital technologies, artificial intelligence (AI), and cyber security issues. Rapid technological developments in quantum computing, biotechnology, AI, and advanced semiconductors raise serious concerns regarding their security, economic and societal implications; this is especially true at a time when the global order is mired in great uncertainty. Therefore, it is important to identify the main contributions of these outstanding regions and the specific ways in which they lead world policy issues in the technological space. It is notable that much is yet to be achieved in understanding the nuanced interactions among Germany, the U.S., and Europe concerning technology governance despite the extensive literature on technology policy and international relations. Therefore, this study took a qualitative research approach to analyse technology policy in the three regions to identify the patterns and trends in how they shape technology governance worldwide. The combined use of constructivist and international relations theories provided a functional theoretical framework through which the delicate balance between technological autonomy and multilateral collaborations is sustained among nations. By examining the relevant policies and interactions among the sampled nations, this study has provided a deeper understanding of how these regions collaboratively address the challenges and opportunities presented by emerging technologies.

Keywords

Technology, Policy, Global Order, Digital Economy, Germany, The United States, The EU

1. Introduction

The intersection of technology and international relations has become increasingly prominent in recent years. As digital transformation accelerates, the implications of technological advancements extend beyond economic growth, affecting security, privacy, and human rights. Germany, the United States, and Europe collectively influence technology policy on a global scale, shaping the regulatory frameworks that

govern digital innovation and international cooperation. Democratic countries of the Global North, Germany included, have reacted to growing digital authoritarianism from North Korea, Russia, China, Iran, and other countries by reiterating their support for digital governance based on multistakeholder institutions such as the Internet Engineering Task Force (IETF), the Internet Society (ISOC), and the Internet Corpo-

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ration for Assigned Names and Numbers (ICANN) [10]. They are also constructing a political blueprint via the Paris Call for Stability and Security in Cyberspace, the Elmau G7 Resilient Democracies Statement, and the Christchurch Call for secure, open, and free Internet. The G7 Democratic Resilience Statement was supported by the countries invited to the Elmau Summit; however, those countries have also been hesitant to situate the Declaration for the Future of the Internet (DFI) and the Paris Call at the core of an international digital order [11]. This has encouraged the staking out of technology-infrastructure location of influence, especially in the Global South. Under Germany's leadership, the G7 has committed to source \$600 billion from public and private investors via its Partnership for Global Infrastructure Investment (PGII), to counter the BRI [10]. In the United States, President Biden has been working on a compelling agenda on critical and emerging technologies (CETs) and reaffirming the goal of remaining as far ahead of the competition and rivals as possible [9]. In the quest for global leadership in technology, Washington has embraced wide-ranging schemes, export control measures, and other policies for strengthening its local industries. Germany and Europe are also on a similar pursuit, although more clarity is needed for them to formulate their strategic technology agendas, autonomously or in partnership with the United States [9]. This paper outlines a comprehensive analysis of the roles these regions play in establishing technology policy and how their actions contribute to the broader world order.

1.1. Background

Historically, technology has been a key driver of economic and social change. In the 21st century, the pace of technological advancement has raised new challenges regarding governance, ethics, and global cooperation. Technology governance might sound like a mundane subject that should primarily concern policymakers and legal scholars. However, the reality is that technology has revolutionized societies and economies, become a major multiplier of power and a serious force in molding and re-moulding global relations. Novel technologies can significantly strengthen a nation's economy, thus increasing its global presence. They can also build capacities that give a country military supremacy or advantages. The standards and values embodied by technology products are set by their conceivers, designers, developers, and manufacturers. The emergence of AI, big data, and the Internet of Things (IoT) necessitates a re-evaluation of existing policies and the creation of new frameworks. The U.S. has traditionally been a leader in technology innovation, while Germany and Europe are increasingly asserting their influence through regulatory approaches, such as the General Data Protection Regulation (GDPR).

1.2. Research Questions

1) How do Germany, the United States, and Europe shape

technology policy at national and international levels?

2) What are the implications of their technology policies on global order and international relations?

3) How do these regions balance competition and cooperation in the technology sector?

1.3. Research Gap

Despite the extensive literature on technology policy and international relations, there remains a significant gap in understanding the nuanced interactions among Germany, the U.S., and Europe concerning technology governance. Most existing studies focus on individual countries or the European Union as a collective entity, often neglecting the interplay between these regions and their joint influence on global norms. Additionally, research has not sufficiently explored how the differing regulatory philosophies – such as the U.S.'s market-driven approach versus Europe's precautionary principle – affect international cooperation and competition in the technology sector.

1.4. Significance of the Study and Contribution to the Field

This research contributes to the academic literature by filling the existing research gap regarding the interactions among Germany, the U.S., and Europe in technology policy. By analysing these interactions, this paper provides insights into how different regulatory approaches can either facilitate or hinder international cooperation in technology governance. Additionally, it offers practical policy recommendations that can guide future collaborative efforts, ultimately enhancing the stability and effectiveness of global technology governance. This study is significant for several reasons. First, it contributes to the growing body of literature on technology policy and international relations. Second, it provides valuable insights for policymakers and stakeholders in navigating the complex landscape of global technology governance. Finally, it highlights the importance of collaboration between nations in addressing the challenges posed by rapid technological advancement.

1.5. Theoretical Framework

The study is guided by a combination of constructivist theory and international relations (IR) theory. The former focuses on how social constructs, norms, and identities shape international relations. This framework helps analyze how Germany, the U.S., and Europe create and disseminate technology policies that reflect their values and interests. Interestingly, constructivism is also part of IR. The social construction of technology (SCOT) hypothesis is a scholarly approach to researching technical transformation in society, in historical and modern contexts [9]. It is also an explanation of the link between technology and

society. Its development is closely tied to the sociology of science, technology, society movement, and scientific knowledge in the 1970s [9]. Its critique of technological determinism marked its genesis. SCOT also presumes that in modern society, the emergence and advancement of social institutions cannot be soundly grasped without considering the influence of technology. IR provides insights into the power dynamics between these regions and how they navigate cooperation and competition. By applying these theoretical lenses, the research explores how technological advancements influence state behavior and contribute to the evolution of global governance structures. IR theory is described as the study of global politics via a conceptual lens [13]. It purposes to rationalize how countries act and interact with one another, and how international political events materialize. IR has four central theoretical constructs: realism, liberalism, constructivism, and Marxism. Realism is a pragmatic strategy that focuses on bilateral power dynamics. It presumes that countries are always seeking to maximize their influence, and that the most influential countries will prosper. Liberalism focuses on national politics and bilateral/multilateral cooperation. Constructivism focuses on the influence of ideas and norms in international politics, while Marxism stresses the place of economics in domestic and global power relations [13]. The paper uses the strong theoretical foundations of social constructivism and IR's international power dynamics to hypothesize that the major world's economic powers exemplified by the US, Germany, and the rest of Europe playing significant roles in the shaping of technological global order and policies. Even though the two theoretical approaches were primarily focused on global politics, economics and social order, this paper extends their principal assumptions to include the inevitable influence of these economies on the global technology policies. The presumed influence of the major world economies is informed by the reality that some of the major technological companies like Microsoft, Apple, GitLab, SAP and Google among others are from America and Europe. Therefore, the two regions are presumably inclined to play significant role in shaping the global technology policies.

2. Methodology

This research employs a qualitative methodology, utilizing a case study approach to analyze technology policy in Germany, the United States, and Europe. By examining key policies, regulatory frameworks, and international agreements, the study identifies patterns and trends in how these regions shape technology governance. Data was collected through:

- 1) Document Analysis: Reviewing policy documents, legal texts, and international agreements related to technology.

- 2) Comparative Analysis: Comparing the approaches of Germany, the U.S., and the EU to highlight similarities and differences.

3. Comparative Analysis: Impacting the Technology Policies at National and International Levels

3.1. Germany

In its 2021-2025 manifesto, the German federal government emphasized the significance of the digital economy in its coalition framework [24]. The government's objective is to multiply investments in various segments of the digital economy, particularly quantum computing (QC), the digitalization of government services, and AI. The Digital Strategy of 2022 compels the current administration to enhance many of these components by the conclusion of its term while also stressing the prominence of digitalization in the national curriculum and boosting access to important data. According to the International Trade Administration, an overarching theme in the strategy is digital autonomy and how to become more sovereign vis-à-vis digital technologies from China and the United States [24]. In contrast, the government's Strategy for International Digital Policy of 2023 stresses the value of global collaboration with allies, including the United States, in realizing its digital goals and working towards net neutrality and the safeguarding of human rights. From a legislative standpoint, EU law overrides Germany's (and other member states') national laws; consequently, most regulations for Germany's digital economy are determined at the EU level instead of nationally. Nonetheless, some laws are still enacted at the national level. These comprise the Online Access Act of 2017 and the NIS2-Umsetzungs- und Cybersicherheitsstärkungsgesetz, which was proposed to legalize the EU's NIS-2 prescription, which obligates all firms with 50 and more workers to adopt cybersecurity buffers, into German law [24]. Data privacy is a serious concern in Germany and is overseen at state and federal levels. Every state has a data protection body that oversees public agencies and private firms. Nationally, the Federal Commissioner for Data Protection and Freedom of Information superintends federal public agencies and the postal and telecommunications.

Germany is noted to have considerable influence in the official phases of digital regulatory policymaking in the EU, which provides the launchpad for European influence in technological geopolitics [10]. For instance, it has been at the center of the EU's pioneering efforts to ground digital regulation in democracy, human rights, and rule of law. As the largest member state, it also dominates the bloc's civil service and parliament. This implies that the EU can only succeed in amending its regulatory framework and achieving digital sovereignty if Germany also updates its mindset. The German Institute for Standardization (DIN), the German Association

for Electrical, Electronic & Information Technologies (VDE), and the German Commission for Electrical, Electronic & Information Technologies (DKE) form the heart of national institutions that influence their European and global peers [10]. Germany, as one of six permanent patrons of the International Organization for Standardization (ISO) Council, hosts 18% of the ISO's secretariats, 29% of the International Electrotechnical Commission's (IEC) working group heads, and 19% of the IEC's secretariats [11]. It also nominates candidates for influential seats, such as its 2022 campaign for the directorship of the International Telecommunications Union's (ITU) Telecommunication Standardization Bureau.

Germany's Strategy for the 2024 International Digital Policy outlines the German government's commitment to protecting freedom and democracy online, molding global standards, employing digitalization to tackle global issues, advocating for a free, secure, and global internet, promoting cross-border data streams, supporting human rights, ensuring stable and sustainable digital societies, and strengthening technology partnerships [5]. This strategy is consistent with multiple policy objectives and stresses the profundity of collaboration at national, regional, and global levels to improve digital security, inclusivity, and governance [6]. For this reason, the government favors a clear and active international digital policy that aligns closely with its defense, climate, foreign, environmental, economic, social, development, and security policy goals. The EU is also an important multiplier and framework for Germany's international digital policy objectives.

3.2. The United States

The Office of Science and Technology Policy has identified several primary deliverables that would drastically alter the country's technological landscape in terms of regulation, coherence, and intentionality [26]. These include a National Strategy to Advance Privacy-Preserving Data Sharing and Analytics, National Objectives for Digital Assets Research and Development, and the Trustworthy and Responsible AI Resource Center for Risk Management [26].

Historically, the United States' global leadership in technology innovation underpins its national interests such as quality of life, economic advancement, and security [16]. The obvious national benefits of this primacy have long piqued the curiosity of adversaries and rivals while inspiring American efforts to shield its technological superiority. This response has largely informed the country's approach to technological regulation in the last few decades, which entails protectionism based on two presumptions: technologies fueling military competitiveness are distinct from those powering commercial goods and services, and technological and economic leadership in many dimensions of its R&D ecosystem [16].

According to the National Academies of Sciences, Engineering, and Medicine, private companies and the federal government have often led the way in the development and

deployment of novel technologies in the market [16]. As a result, they have determined market conditions, established the customer base for novel technologies, and built regulatory frameworks supporting those technologies. However, the assumption that the country will remain dominant by relying largely on its historical strategy of identifying unique technology areas needing restrictions is invalid because of a rapidly evolving competitive and technology arena [16]. The historical approach is also challenged by the diffusion of highly internationalized and integrated portals enabling and driving most contemporary technology applications.

The CHIPS Act has signaled the country's departure from protectionism to targeted state-funded or private investments in key sectors and universities, supported by emphasis on partners as close collaborators in technological advancement [4]. For example, the government has allocated billions of dollars to the expansion of the Defense Advanced Research Projects Agency (DARPA), the National Science Foundation (NSF), the Advanced Research Projects Agency-Energy, the Intelligence Advanced Research Projects Agency, the Science and Technology Directorate, and the National Institutes of Health [4]. It is also supporting the creation and funding of broad steering committees, such as the National Network for Critical Technology Assessment to evaluate the state of technological sophistication and invest proactively and strategically in key start-ups, university research projects, industries. The Department of Commerce is spearheading a \$50 billion program to reawaken the semiconductor sector, including expansions to R&D and manufacturing [4]. Altogether, these efforts are designed to strengthen American technological innovation in a deliberate and far-reaching manner to keep it at the vanguard of great power competition.

The Trump and Biden regimes implored Congress and strove for various initiatives via the Executive to secure the country's technology dominance [3]. These policies can be classified into two broad categories: defensive, or protectionist, which involves hedging national interests from foreign competitors, and offensive, which entails building a national capacity [3]. The US approach to technology regulation is liberal and creates plenty of room for self-governance by private actors [15].

3.3. Europe

According to the European Parliament, the digital transformation is among the EU's key priorities [22]. The European Parliament is at the forefront of the continent's efforts to shape the policies that will buttress its wherewithal in novel digital technologies, support the digitization of government services, support its green evolution, help it to achieve climate neutrality in the next 30 years, support training for employees and acquisition of digital skills, and create new opportunities for customers and businesses all while maintaining respect for fundamental values and rights. After recognizing the many societal benefits of increasing digitalization, the EU has

worked to improve its set regulations and digital sovereignty instead of following regulations set by foreign actors. This is intended to prepare it for the digital age. The EU's Digital Decade policy framework anchors the region's digital evolution and includes clear objectives and targets for 2030 [22]. Von der Leyen defined technological sovereignty as "the capability that Europe must have to make its own choices, based on its own values, respecting its own rules." In 2021, the European Commission tabled its proposal for the regulation of AI (AI Act), which suggests classifying AI systems based on the risks they present to users. Upon approval, they became the first rules on AI in the world. For AI development to succeed in Europe, the EU must have a sound data strategy. In 2022 and 2023, Parliament adopted the EU Data Act (DA) and the EU Data Governance Act (DGA) to help unleash the potential of AI and big data. In 2021 and 2022, Parliament enacted new rules to deter the spread of terrorist content digitally [22]. In 2021, Parliament ratified the creation of a new continental cybersecurity hub. To better protect businesses and Europeans from cyber threats, Parliament enacted the Network and Information Security directive (NIS-2), the Cyber Resilience Act, and the Digital Operational Resilience Act in November 2022 [22]. Parliament recognizes the importance of online platforms in people's lives and the economy. It also acknowledges that they present serious concerns. For this reason, it has enacted the Digital Markets Act (DMA) and the Digital Services Act (DSA) to promote growth and innovation, enhance online security, protect press freedom, democracy, and free speech, foster competitiveness, and confront illegal content [22].

The European Chips Act, which is the EU's version of America's CHIPS and Science Act, purposes to expand the continent's semiconductor output and increase its competitiveness, technological supremacy, and independence now and in the future [22]. The Act intends to increase the EU's quota of global production capacity to 20% from the current share, which is below 10%. In October 2023, Parliament approved new regulations on the use of intelligent transport systems (ITS) in land transport, with the view of making digital traffic data more available, promoting data sharing between mobility applications, and supporting digitalization in the transportation industry, thereby increasing sustainability, road safety, and efficiency [22]. The growth of the online video game segment and its contributions to the digital evolution of the EU prompted Parliament to adopt a report proposing harmonization of EU regulations to improve protection of players.

The European Commission adopted the Communication on ICT Standardization Priorities for the Digital Single Market in 2016, with the aim of prioritizing and providing a sustainable and efficient system for setting ICT standards that tackles the issues pertaining to the digital evolution of society and the economy [21]. The Standardization Strategy (2022) explains the Union's interpretation of standards confronting the challenges created by the digitization of its economy. The Union

backs a clear and effective system of standardization, provides standardization requests, and funds the standardization bodies such as the European Telecommunications Standards Institute (ETSI), European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) [20]. Nonetheless, it does not interfere with the settings imposed by national or industry standardization organizations. Innovation and research projects sponsored by the EU publish their findings as a complement to the standardization efforts of various standards-setting entities. In this regard, the EU Rolling Plan for ICT Standardization offers a brief of the standardization efforts to be pursued to further EU policies. The European Multi-Stakeholders Platform (MSP) was established in 2011 to support the ICT standardization policy. According to the European Commission, its role is advisory, and its membership includes European and global standardization authorities and other important stakeholders in the ICT standardization fraternity [20]. It also identifies ICT technical requirements for government procurement, formulated by ICT consortia and working groups, and promotes strong partnerships among actors in the standardization arena. A communication on the framework for preventing technology lock-in by employing open standards in government procurement was released in 2013 [21].

The EU's technology regulatory framework is robust, so much so that it is considered a regulatory superpower [15]. The GDPR, which regulates how Europeans' private data can be gathered and processed, is the best example of the Union's firm regulatory approach [15]. It is expected that some of the provisions in the DGA can inspire a future regulatory agreement with the United States on non-personal streams of data. The GDPR is the gold standard of data protection among international technology firms, including in countries outside Europe. Countries such as Japan, Argentina, Kenya, and South Korea and jurisdictions such as California employ the GDPR as the foundation for their data protection policies [11].

4. Implications of the Technology Policies on Global Order and International Relations

4.1. Germany's Technological Diplomacy

Support for secure, global, and open digital connectivity is a cornerstone of Germany's foreign policy. The government's devotion to a rules-oriented order and multilateralism strongly influences its international technology policy strategy [10]. Germany is a major player in the development of a multilateral framework for technology collaboration. For example, following the conclusion of the UN High-Level Panel on Digital Cooperation, it, alongside the United Arab Emirates, presented proposals for an architecture for international collaboration comprising an amended Internet Governance Forum (IGF) [14]. It organized the IGF in 2019 and is contem-

plating hosting the 2025 edition. Germany is also promoting the creation of a universal cyberspace order. The order backs the Paris Call for Trust and Security in Cyberspace and is involved in the Organization for Security and Co-operation in Europe, the UN open-ended working group (OEWG) on ICT in relation to global security, and the Council of Europe's efforts on data protection (Convention 108+) and artificial intelligence (CAHAI) [10].

Germany's Strategy for the 2024 International Digital Policy reaffirms its dedication to Net Neutrality (Krewer, 2024). It also stresses the significance of tackling new critical elements of Internet regulation by advocating protection and promotion of open-source foundational innovations as the technical centerpieces of digital sovereignty and the global Internet (Krewer, 2024). Germany's involvement in global projects like GovStack and the Digital Public Goods Alliance validates the credibility of its commitment. This is especially crucial because the perception of the Internet as a realm of collective responsibility and collaboration instead of a Hobbesian *cyberspace* must be urgently reaffirmed (Krewer, 2024).

The German government's Strategy for the 2024 International Digital Policy strengthens its global positioning, which is explained in, among others, the China Strategy and the Cyber Security Strategy [6]. It is consistent with its National Security Strategy, which is guided by the United Nations 2030 Agenda in crafting the global digital evolution sustainably and with the objectives of protecting human rights in the digital shift included in the government's Human Rights Action Plan [5].

4.2. The United States' Technological Diplomacy

The first openly and tightly contested geopolitical tussle over a technological innovation since the close of the Cold War involved Europe's choice of suppliers for the launch of 5G [7]. Under the Trump Administration, the United States made the prohibition of Chinese vendors from the EU's future network system an assessment test for the transatlantic treaty. In many EU member states, Washington adopted a *with us or against us* policy that had a profound effect on a matter previously thought to be a routine financial consideration for European telecommunications entities [7]. According to the White House, the United States is collaborating with like-minded allies so that the third installment of the digital transformation creates a technological environment distinguished by trust, security, resilience, integrity, and openness, and which strengthens human rights and democratic ethos [26]. The Presidential Initiative for Democratic Renewal, launched by President Biden, targeted diffusion of the government's attempts to grow and protect democratic stability with likeminded allies through foreign aid and diplomacy. The Biden Administration's strategy for leveraging democracy through technology is informed by three main themes: challenging the emergence of digital authoritarianism and tech-

nological misuse, fostering digital freedom and democracy in the digital era, and molding emerging technologies to ensure democratic principles and human rights are respected [26].

The federal government's commitment to digital solidarity with allies that share its vision for an open, secure, and dynamic technological future is demonstrated by its launch of the U.S. International Cyberspace and Digital Strategy, which uses digital solidarity as a reference point [19]. Solidarity underpins the government's approach to digital technologies and all fundamental technologies. The United States is leveraging technology to better the lives of its citizens, its allies, and mankind. It believes foundational and emerging technologies can and must be employed in fueling prosperity and growth, solve common global issues, and promote reverence for human rights [25]. The government uses diplomacy to strengthen consensus on the potential for technology to propel opportunity, good, and modernization rather than crush dissent, conduct mass surveillance, frustrate human rights, repress democracies, and promote polarization. The government is working to increase international momentum around exploiting AI for achieving the UN's Sustainable Development Goals (SDGs) [24]. In this regard, it led to the enactment of the first ever unilateral resolution on AI in the UN General Assembly, which it formulated and pushed through with the support of 120 other nations and more than 120 co-sponsors. The resolution provides a basis for optimizing AI for social and economic development while safeguarding human rights. The United States is also pursuing multilateral partnerships in research, biomanufacturing, and supply chains to ensure that synthetic biology is used for the benefit of the American people and humanity [25]. It partners with local private entities so that domestic innovation promotes global good. Domestic governance policies are the cornerstones of the American government's global AI diplomacy. For instance, the key aspects of the federal government's AI frameworks have been embraced by the G7 economies, which include Germany, the United States, and the EU, which is a non-enumerated member; as a result, they shape the broader AI trust and safety discourse and are incorporated into the UN Resolution adopted by almost all the international community. It appreciates that good AI governance also extends to the military domain, which is why it is spearheaded the Political Declaration on Responsible Military Use of AI and Autonomy that has already been approved by 55 nations [25].

The government is cooperating with allies such as the G7 to create privacy and security and counter harmful applications, establish global cyber standards, and create buffers against the misuse of CETs [25]. To guard against the security risks posed by QIST, the government has established various standards, including algorithms developed by NIST to resist quantum breaches. NIST is in the process of internationalizing these algorithms so that they can be embedded in the encryption systems of organizations and businesses that need them. The United States' experience with 5G has reinforced the reality that it cannot sit back and watch as strategic rivals hog the

technologies that constitute the core of the global economy and influence how and where data flows. This is why it is deploying its diplomatic instruments to enable innovative American firms and its allies to compete fairly and preserve an open, stable, and secure technology realm. It is also open to working with any business or country that shares the same values, rather than just American companies. It has invested in the laying and operation of undersea cables to link every part of the world and collaborated with Taiwan, Japan, Australia, and New Zealand to install a cable that connects as many as 100,000 people in the Pacific Islands [25]. It is also supporting homogenous efforts in Africa, South America, and the Indo-Pacific. The government is working with verified suppliers, isolating untrustworthy vendors from the data storage and cloud computing ecosystem, creating economies of scale with its allies, and exploiting its competitive advantage so that it can prevent authoritarian use of both technologies.

The other aspect of the U.S.'s technology diplomacy is the creation of trusted and stable technology environments. It established the Minerals Security Partnership (MSP), whose membership now includes 14 nations and the EU, which cumulatively account for over 50% of global GDP [25]. The MSP is involved in almost two dozen undertakings globally and throughout the supply chain. A similar approach has been adopted for semiconductors. Since it cannot, does not need to, and does not want to manufacture everything domestically, the United States is incentivizing its allies to invest in their semiconductor innovation infrastructures [27]. The International Technology Security and Innovation (ITSI) Fund of the CHIPS Act is allocated \$500 million to help secure and diversify all links in the silicon supply chain, partnering with allies such as Indonesia, Mexico, Panama, Philippines, Costa Rica, and Vietnam.

4.3. Europe's Technological Diplomacy

In 2019, Ursula von der Leyen, the European Commission president, outlined her hopes for a geopolitical commission. She proceeded to select Addis Ababa, the seat of the African Union headquarters, as her first overseas trip, indicating that the EU would prioritize Africa [8]. In 2020, the Commission released a joint communication named *Towards a Comprehensive Strategy with Africa*, in which it proposed collaborations on digital transformation, among others. Thanks to the rising importance of critical minerals in high-tech devices and defense systems, and their exposure to supply shocks, the EU has worked to make their supply chain more diversified and stable [8]. Since Africa boasts around 30% of the critical mineral reserves in the world, the EU has focused on creating strategic routes with African nations to augment its security. For instance, since 2020, it has signed raw materials deals with Zambia, the Democratic Republic of Congo (DRC), Namibia, and Rwanda. It has also inked a Memorandum of Understanding to back the construction of the 1,300-kilometer

Lobito Corridor along Zambia, the DRC, and Angola; this railway route will facilitate transportation of strategic minerals and critical raw materials [8]. The EU has also launched the Global Gateway, a €300 billion blueprint to fund connectivity and infrastructure projects globally, but especially in Africa [8]. The Global Gateway is seen as a way for the Union to achieve its goals of becoming an international geopolitical superpower by providing an alternative to the Road and Belt Initiative (RBI) in the international infrastructure arena. It strongly insists on providing infrastructure to esteemed standards of governance, transparency, and sustainability – unlike Chinese finance.

Anxious about the technological dominance, divergence, and influence of China and the United States in digital standards and practices such as data governance and data protection, von der Leyen has become more outspoken on the EU's need to become more influential in the global digital evolution [12]. In this sense, the concept of the EU's Digital Sovereignty has developed as a way of increasing the bloc's capacity to act as an autonomous player in the digital arena. This concept has evolved into the 2030 Digital Compass, in which the Union explains its digital vision, underpinned by a human-centric view of the digital economy, stressing democratic values and personal rights such as freedom as protection of user data and freedom of expression [12]. The EU's standard-setting strategy and view is designed to make other powers and countries dependent on its regulations; this is noteworthy because standards, once established, are costly or complex to reform [7]. By promoting the development of trustworthy AI, for instance, the EU can create benefits for people and businesses that use AI-based systems and humanity. The EU exports its regulations and wants the global regulation of data to adhere to its democratic and human-centric standards.

5. Balancing Technological Competition and Cooperation Among the Three Entities

5.1. Germany and the United States

In 2021, Germany enforced new competition rules, with its first targets being Google, Amazon, Apple, and Meta – the holding company of Facebook. It is worth noting that apart from being the biggest technology firms in the world, these companies are all American. However, the German Cartel Office deemed them of profound importance across markets, making them prime targets of its efforts to eradicate anti-competitive conduct in its technology industry, with emphasis on the digital economy, data processing, and self-preferencing. On 22nd May 2024, Germany and the United States inked a Joint Statement on Cooperation in Quantum Information Science and Technology (QIST) [17]. According to the National Quantum Initiative, the two coun-

tries also held a Joint Committee Meeting on science and technology partnerships. The statement demonstrates the two countries' rich history of QIST R&D cooperation based on common values and a shared understanding that pooling their expertise is vital to optimizing QIST innovations for the benefit of mankind. By acknowledging the potential and challenges of quantum technologies, the statement signified the two nations' belief that cooperation is the lifeblood of progress. The United States and Germany have made massive investments in QIST; for example, the former's National Quantum Initiative put in about \$1 billion annually while the latter's Quantum Technologies Action Plan provides roughly €2.2 billion for QIST up to 2026 [17]. There are also active partnerships between the National Science Foundation and the German Research Foundation (Deutsche Forschungsgemeinschaft, or DFG), NIST and Physikalisch-Technische Bundesanstalt (PTB), NASA and the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt, or DLR). On top of their bilateral ties, Germany and the United States are among the founding patrons of the Entanglement Exchange, a platform providing global exchange opportunities for QIST researchers, students, and postdoctoral fellows [17]. German firms can be admitted into the United States' Quantum Economic Development Consortium (QED-C), and the two countries have also partnered with other allies via multilateral engagements to formulate Principles for a Global Quantum Ecosystem Informed by Science.

5.2. The United States and Europe

The EU's efforts at regulatory enforcement are largely concentrated on the Euro-Atlantic [11]. For instance, enforcement of the GDPR among the 17 Data Protection Authorities (DPAs) in Germany targets American platforms and service providers. This is justifiable considering the ubiquity of American digital services in Europe in the last decade [11]. Through the TTC, the United States and Europe help their companies remain competitive as they forge regional and global rules for emerging innovations that represent their common interests and values [27]. TTC has also given both parties freedom to express their respective divergences. For instance, they have renewed trust, allowing them to solve issues on which they did not converge. A good example is the sustenance of transatlantic data streams that underpin their one and half-trillion-dollar transatlantic bond [27]. In 2020, the Court of Justice of the European Union revoked the framework, on which over 5,000 American firms depended to transact transatlantic trade in adherence to EU data protection policies. Using the TTC, the two entities found a resolution that satisfied requirements on both ends of the Atlantic, via the U.S.-EU Data Privacy Framework [27]. Significant progress has also been achieved on the streamlining of technology standards, especially in relation to semiconductors, to make transatlantic supply chains more resilient. The United States and the EU are cooperating in the enforcement of their

CHIPS and Science Acts. According to the U.S. Mission in Germany, they are also working together to confront the non-market behaviors of the PRC, including its exploitation of its companies to perpetrate technology transfers and intellectual property (IP) theft against U.S. and European entities [27].

Historically, the EU's dedication to open markets and commitment to international cooperation has been its strength, and its policymakers continue prioritizing these doctrines [1]. The region recognizes that global R&D partnerships, international industry-led standards, and international markets are central to efficiency, resilience, security, and innovation in technology-centric industries. This is illustrated by its involvement in international value chains of advanced semiconductors and its traditional approach to industry-based technology standardization [1]. Europe understands that it cannot spell out its own standards and rules and expects the rest of the world to comply [7]. It also appreciates the fact that the *Brussels Effect* will not easily recur because it materialized when technology was still underestimated by the geopolitical landscape. Today, state and nonstate actors understand the close interconnections between technology, political power, and regulation [7]. The EU, therefore, has embraced the challenge of cooperating with like-minded nations and multilateral agencies in Europe (the Organization for Economic Co-operation and Development, OECD), Africa, the Indo-Pacific, and Latin America to establish value-based, fair, and open technological standards [7].

In October 2023, the United States and the EU signed a five-year extension to the U.S.-EU Science and Technology Agreement. The Agreement, which was first signed in 1997, has established a lasting and robust strategic treaty for research between the two parties. The Agreement, which hinges on common principles and values such as transparency and research integrity, spans areas such as energy, CETs, and the environment. In December 2023, the two leading industry associations from both sides of the Atlantic crafted a 6G outlook and industry roadmap [18]. The roadmap is an elaborate condensation of important strategic recommendations, future partnership opportunities through American and European funding avenues, and reflections for 6G services and networks, channeling the priorities and perspectives from the Smart Networks and Services Joint Undertaking (SNS JU) and the Next G Alliance [18].

In December 2021, the European Commission, the Antitrust Division of the US Department of Justice, and the US Federal Trade Commission (FTC) launched the Joint Technology Competition Policy Dialogue (TCPD), which supports development of shared strategies and strengthening of the partnership on competition enforcement and policy in technology [20]. The three entities have a storied history of close collaboration in the formulation and enforcement of antitrust policy, which started even prior to the official 1991 pact between the Government of the United States of America and the Commission of the Eu-

European Communities concerning the enforcement of their competition policies [21]. Both parties appreciate that the rapid proliferation of AI and the expansion of data monopolies increase the competitive risks posed by gatekeepers of digital hegemonies. As such, sharing best practices helps them to more effectively serve their citizens. The TCPD encompasses high-level technical discussions and meetings on how to strengthen collaboration to uphold fair competition, how best to assess shifting market dynamics in the digital terrain, and rapidly advancing technologies [21].

6. Discussion

According to the International Trade Administration, Germany became one of the first countries to adopt a national AI policy in 2018 [24]. The government sees AI investments as essential aspects of national security, global competitiveness and influence, and the labor market. The government's Cyber Security Strategy (2021) also emphasizes digital sovereignty. The Gigabit strategy (2022) asks for increased investments in fiber optic systems, with the aim of connecting half and all the country via Fiber to the Premises (FTTP) by 2025 and 2030, respectively [24]. Germany is one of the global leaders in introducing Open Radio Access Network (ORAN) technology. ORAN intensifies competition because equipment is interoperable. The Federal Ministry for Economic Affairs and Climate Action's innovation policy is centered on the slogan: *from concept to market success* [23]. The government enacted the Act on Tax Benefits for Research and Development to make the country more attractive to foreign and domestic investors in technology and innovation [23].

In the absence of Germany and the influence of its private sector in international bodies that set technical standards, the EU's regulatory power would be curtailed [10]. In turn, the EU provides it with a base for shaping global regulatory norms. Additionally, the ability of German technical standard agencies and private companies to mold international technical standards is resurrecting [11]. As a member of the EU, Germany is active in three core fields of cybersecurity and data governance: autonomous cloud usage policies, open data and digital identities, and legal access to digital messaging systems. It has also enjoyed success as the EU's major incubator for regulatory policies for digital technology; by extension, it is an influential backer of the *Brussels Effect* – the hypothesis that the EU's regulations are binding to the rest of the world – of governing global markets.

According to the U.S. State Department, the United States has reformed its policymaking instruments and perspectives to boost its technological competitiveness at home and abroad [25]. The CHIPS Act and the Inflation Reduction Act, enacted under President Biden, have generated enormous private and public investment in the technology sector, with the goals of innovating, competing, and scaling. The federal government is adamant that formulating technological policies from a

position of strength enhances the country's capacity to design, develop, and launch technologies that will affirm its ability to determine the future of technology. It also better positions the country to advance standards and set norms across the globe. The government's technological policy approach underscores the importance of digital solidarity – as opposed to Germany and the EU's preoccupations with digital sovereignty [25].

Defensive aspects were a top priority under the Trump administration's resolutely hawkish view and treatment of China and levying of tariffs [3]. The Biden administration has favored a more nuanced approach for technology supremacy that highlights offensive and defensive elements. Expanding domestic technological capacity was a primary strategic pursuit in the first two years of President Biden's term [3]. Taking advantage of Democratic majority in the House and the Senate, the Biden Administration consolidated national investments in economic sectors of strategic importance, especially science and technology innovation. This opened the door for an avalanche of industrial policies unprecedented in the last half-century. Apart from the Inflation Reduction Act and the CHIPS Act, Congress enacted the Infrastructure Investment and Jobs Act [3]. The Inflation Reduction Act and the Infrastructure Investment and Jobs Act are widely regarded as seminal markers of industrial policy legislation in civilian sectors.

The Congress, under President Biden, was inclined towards a similar approach to the European Commission in its regulation or attempted regulation of digital content intermediaries such as social media companies to ensure due diligence, transparency, and compliance with reporting standards [15]. This is reflected in three proposed legislations it is considering: the Online Consumer Protection Act (OCPA), the Eliminating Abusive and Rampant Neglect of Interactive Technologies (EARN IT) Act of 2020, and the Platform Accountability and Consumer Protection Transparency (PACT) Act. If enacted, these pieces of legislation would significantly amend the immunity offered to online content mediums by Section 230 of the Communication Decency Act (CDA). Unlike these proposals, however, the EU's e-Commerce Directive of 2000, a European iteration of Section 230, upholds the immunity of online content intermediaries [15].

There was a big change in the government's view of AI under the Biden Administration as it evolved [2]. Through various executive orders, blueprints, interventions, and voluntary frameworks, the federal government has mostly implemented the EU's risk-oriented AI strategy in terms of objectives and risk assessment [2]. This adds to the perception that the EU is the default setter of rules that regulate the international digital economy, including the conduct of American firms.

To make taxes more equitable and minimize tax avoidance, the EU is pursuing new regulations that allow profits to be taxed in jurisdictions where companies have significant operations [22]. It has also adopted a minimum tax cap for multinational firms in its territory in consistence with an in-

ternational pact on the issue and is exploring regulations for crypto-assets and their technologies to increase their development and safeguard users. Parliament has proposed the Gigabit Infrastructure Act to help minimize bureaucracy and costs in the building of very high-speed digital linkages. The EU sees digital solutions as a central component of its global competitiveness and economic recovery and a haven for lucrative opportunities. The Union's blueprint for economic recovery post-COVID compelled member states to commit at least 20% of the €672.5 billion Recovery and Resilience Facility to digital transition [22]. Other investment programs, including Connecting Europe Facility and Horizon Europe, apportion massive amounts for digital developments. In general, EU policy is to approve digital goals across all programs; however, some new regulations and investment programs are targeted at achieving them. In 2021, Parliament approved the Digital Europe program, the Union's pioneering financial tool dedicated exclusively to taking technology to people and businesses by investing in digital infrastructure to increase Europe's green transition, technological autonomy, and competitiveness through strategic technologies. According to the European Parliament, the program will channel €7.6 billion towards supercomputing (€2.2 billion), AI (€2.1 billion), cybersecurity (€1.6 billion), advanced digital skills (€0.6 billion), and ensuring a wide use of digital technologies across the economy and society (€1.1 billion) [22].

The GDPR is partly the source of pressure on the US federal government to enact a national data protection law [10]. In 2020, the Schrems II ruling compelled the United States to radically alter its approach to handling European complaints and increase restrictions on data collection by intelligence services [11]. China has also developed an affinity for quoting EU laws as it works towards much less high-level set of objectives. For example, its Blocking Statute of 2021, which revokes extraterritorial embargoes within its borders, is inspired by EU regulations. Its regulations on algorithms, personal data safeguards (such as the Global Initiative on Data Security of 2020), competition, and content borrow from and sometimes even employ the letter of EU law. Germany is actively leveraging its vast development footprint and diplomatic network to engage the Global South on technological matters [11]. Recently, it has resurrected consistent digital interactions with important countries such as India, Japan, and Brazil, to develop joint development and research projects, coordinate efforts in multilateral contexts, and deliberate cyber issues. The bilateral approach has been effective, and Berlin is thrashing out similar technological talks with Indonesia, Argentina, and South Korea. Germany has also identified Africa's strategic essence in the digital domain [11]. As a result, since 2015 it has pumped €164 million into digital investments via its *Digital Africa* program and launched over 200 public-private partnerships (PPPs) in the African technology industry [10]. The foreign and digital ministries are weighing institutionalized digital talks with multistakeholder involvement from the civil society, subnational jurisdictions,

and the private sector in South Africa, the African Union, Ghana, and Kenya. Increased digital collaboration with Egypt is in the offing. Technology diplomacy is ingrained in a bigger shift toward a uniquely geostrategic view of technology policy at the European level; this is informed by the fact that the EU's Digital Compass for 2030 reiterates that technology is a component of global influence and emphasizes the connection between European ideals and digital sovereignty.

The United States works to check Russian and Chinese influence, protects and supports the interests of its biggest technology firms globally, and seeks to sustain its leadership in military AI and other technologies [7]. It also deprives other countries of access to vital technologies, seeks to dominate and secure critical supply chains, particularly of semiconductors, monitors key investments in technology to prevent security threats, and levies embargoes and export restrictions on sensitive technologies. Through initiatives like The Clean Network, the United States aspires to end the need for Chinese 5G among its allies [7].

The United States has assumed the role of a global superpower in the geopolitical context of a global order established by novel technologies. This power stems from important technologies such as QIST, semiconductors, AI, and biotechnology [9]. The government, together with its partners, invests in curtailing its rivals' efforts to obtain or use technologies with apparent links to human rights violations and military capabilities, such as by carefully limiting exports of advanced semiconductors, the foundations of future military applications and frontier AI. To successfully implement this vision, it is crafting a diplomatic corps and a State Department with the capacities to shape, instead of just responding to, the strategic terrain. The government has led an elaborate effort to hire, recruit, and train talented individuals with technological skills, such as chemists, PhD biophysicists, and computer scientists to promote its diplomacy with technological acumen. It is increasing the technological proficiency of its foreign consulates and embassies and aims to have an expert digital attaché in all embassies by the end of 2024 [9]. It is also expanding its outreach to civil society, the private sector, and academia worldwide to inform its technological diplomacy and deepen its thinking while helping it prepare for future innovations. For instance, since the onset of the war in Ukraine, the U.S. and its allies have supported Ukrainians in strengthening their networks and the resilience of domestic communications and various critical infrastructures and moving critical government data to the cloud [9].

As the biggest investment and trade partnership in the world, the TTC supports projects, on a global level, that comply with its common values and advance a rules-oriented economic framework [27]. It has welcomed leaders from developing nations, such as Jamaica and Kenya, to establish new partnerships on digital connectivity and contemplate how the U.S. and the EU can engage developing countries better to support secure digital systems. On top of this, the TTC promotes its values on the Internet, supports stable and secure

digital connectivity in developing nations, promotes partnerships on emerging and novel technologies, supports the establishment of robust semiconductor supply chains, and advances security, economic prosperity, and trade [27].

Russia's war against Ukraine has accelerated the EU's plan to convert its regional and international influence into practical foreign policy through the TTC, the Global Gateway, and a TTC with India [11]. The US-EU TTC is becoming a tool for democratic synergy on various global issues. The EU has also established a base in Silicon Valley to reinforce transatlantic and global discourses on digital frameworks. The TTC is crucial to establishing the normative standard that regulates US-EU trade ties to the novel data-oriented reality in which the global economy is becoming more digitalized and affecting global trade [15]. Countries, such as China, with access to massive data pools are more globally dominant. As a result, the TTC, which enables the flow of data across the Atlantic through a framework that respects privacy and security, enhances the global competitiveness of U.S. and European firms [15]. The TTC's data governance policies ensure seamless data flow while upholding democratic values; this allows the U.S. and the EU to set global benchmarks for other nations to follow and counter authoritarian tendencies of Russia, China, and other powers that promote techno-nationalist, oppressive, and illiberal forms of international governance. The TTC also promotes the link between research bodies and experts from other international actors such as Brazil, China, or India [15].

The United States and Germany favor a bilateral technological strategy that is competitive yet nonconfrontational and non-belligerent [27]. Germany's China Strategy, for instance, demonstrates that its perception of the threats posed by the Peoples Republic of China (PRC) aligns with that of the United States. This implies that the two countries can collaborate to support fair market conduct and oppose those that challenge their rules-based doctrines [27]. The United States and the EU are adapting their regulation-setting approaches to changing geopolitical dynamics in the global technology order [28]. The U.S., for instance, is becoming increasingly proactive and interventionist in establishing global technology benchmarks. The EU, on the other hand, is exploring an alternative to China and the U.S. that juggles cooperation and competition to protect its values, including interoperability that have historically advanced its single market and the international economy.

The modern EU policy is underpinned by the paramount objective of strategic autonomy, which includes various technological, security, economic, and defense aspects [1]. EU industrial and technology policy efforts, for example, seek to increase technological competitiveness and ensure its global leadership and strategic autonomy while simultaneously reducing technological reliance on third nations. The United States and the EU share the view that futuristic connectivity can promote a more secure, inclusive, and sustainable global economy [20]. They agree on common doctrines for the research and proliferation of 6G wireless communication technologies and acknowledge that through cooperation

they can foster the development of global technologies and technical standards for future vital digital infrastructure that embody common values and principles [21].

7. Conclusion

As technology continues to reshape the global landscape, understanding the roles of Germany, the United States, and Europe in technology policy is crucial. This research has analyzed the three entities' contributions to global order from a technological perspective. By examining their policies and interactions, this study has provided a deeper understanding of how these regions collaboratively address the challenges and opportunities presented by emerging technologies. In the US and the EU, the TTC has promoted American and European prosperity and competitiveness and the diffusion of liberal, market-based values by enhancing trade and investment in goods and services of novel technologies, increasing American and European industrial and technological leadership, promoting and protecting CETs and infrastructure, and strengthening innovation. The EU has embraced global collaboration and cooperation in technology-oriented industries to ensure international relevance and competitiveness, while simultaneously considering the shortcomings of isolationist strategies. It is evident that Germany, the United States, and the EU are and will continue cooperating, competing, and defining and redefining global order through technological leadership. These entities are positioning themselves as powerful players in international discourses about technology governance and encouraging their allies to share their sense of immediacy. If they adopt isolationist approaches to technology issues, they risk eroding their legitimacy and ability to win over other actors. Worse, they could create vacuums for external players to occupy. However, if they collaborate closely, they will boost their collective strength and global leadership by illustrating that their standards, regulations, and rules are effective domestically. In this regard, they can benefit from their allies' diplomatic influence in different regions. Finally, these countries must individually and collectively think and rethink the global second order and third-order implications of any moves they make in the technological landscape. They must recognize that their decisions and actions affect their geopolitical influence, their soft power as reference points, their positioning vis-à-vis the plans of other important actors, and their geopolitical latitude to manoeuvre.

8. Future Research

Further research is needed in Germany, the United States, and Europe to develop innovative ways of reducing the risk of supply chains being severed during natural disasters and military conflicts, courtesy of monopolization of technology manufacturing capacity by select geographic zones. The three governments also need to explore how to ink technology

partnerships that should make key technology supply chains increasingly secure, stable, and more heterogeneous. This will allow them to diversify and augment critical mineral supply chains to satisfy growing demand while deterring harmful dependencies. To maintain its position as the global standard setter and technological leader, the United States must research how to create the best labor force worldwide. To achieve this, it must prioritize attracting, training, and retaining high-tech workers and innovators. It should also research how to streamline its visa application procedure, create new avenues for foreigners with AI skills to enter the country to study, train, and research, and form partnerships and academic exchange programs worldwide. As part of its aspirations for a Digital Single Market, the EU should investigate how to enhance cross-border data streams and protection of user data and simplify regulations. The EU Parliament, which wants Europeans and businesses to fully exploit technological innovations through the European skills agenda, needs better evidence of how to best teach digital skills to 42% of its citizens, who lack them. The United States wants its AI regulatory policies, especially its AI Safety Institute, to anchor testing, rules, and standards that will ensure that AI benefits humanity while neutralizing threats. In this respect, it must conduct research to find effective ways of cooperating with developing nations, which must have a seat on the table. In Germany, the Federal Ministry for Economic Affairs and Climate Action's intends to strengthen the country's innovation capacity by cultivating an environment that is investment-friendly and creating funding programs aligned with market needs. This must be supported by proper scientific evidence to determine how such funding programs will support small and medium-sized enterprises (SMEs) to adopt digitization and new technologies, encourage young people to choose careers in natural sciences and technology, and build a sufficient pool of skilled laborers for the future. The ministry's goal of making the country the most innovative in the world and a global leader in pioneering progressive technologies for the present and the future can only be achieved through enhanced and concerted domestic, regional, and international research efforts. More insights are needed to clarify how the EU plans to expand the prevailing push in the African Union's framework for digital transitions and to harmonize them with its domestic programs, including the EU Green Deal and the EU Digital Compass. The EU's stress on foreign value-driven infrastructure investment in digital and green realms, and their alignment with the Build Back Better World (B3W) policy of the G7, also needs deeper interrogation.

9. Policy Implications

- 1) Transitioning from emphasis on addressing market weaknesses to a generative policy strategy. Germany has the chance to lead the EU in advancing this agenda and establishing a European Public Digital Infrastruc-

ture Fund.

- 2) Identifying more areas of collaboration with the goal of sharing technological innovations, optimizing sectoral expertise, collectively tackling issues in strategic industries, and securing data flows, financial commitments, regulatory compliance, IP protection, and conformity with legal and human rights values.
- 3) Prudently balancing the quest for domestic values in investment, trade and technological policy with the global need for competitive and free markets and collaborative ties to avoid risks such as geopolitical conflicts, conflicting interests, protectionism, undermining international cooperation, and the enactment of trade barriers. Achieving this balance in policymaking can prevent inadvertent adverse implications for global division of labor and cooperation.
- 4) Domestic policymaking should emphasize cooperation with likeminded global allies in high-tech segments that are central to the economy.
- 5) Avoiding discriminatory policymaking strategies when formulating technological and industrial benchmarks. This can create economic stagnation and strain global ties, leading to socio-political exclusion.
- 6) Implementing targeted approaches in accordance with elaborate industry analyses, considering international industrial partnerships and the rewards of global specialization.
- 7) Using access to domestic digital economies as bargaining chips for augmenting alliances. For instance, the EU can employ its financial institutions in supporting EU companies to invest in nations that want to adopt CETs while reducing their reliance on Chinese technologies. Germany, the United States, and Europe can consider creating a compelling and holistic technology package that promotes geopolitical ambitions.
- 8) Creating an international data privacy framework through multilateral agencies such as the International Monetary Fund (IMF) that suits all democracies, rather than merely ratifying regulations while hoping other countries will embrace them.
- 9) Formulating new resilience policies for 6G networks, from post-attack recovery to supply chain, spanning detection, prevention, and response to attacks.
- 10) Collectively creating proofs-of-concept (PoCs) for technology, aimed at specific vertical sectors that will adapt alongside the foundational studies to perform tests, trials, and demonstrations as technologies take shape.
- 11) Formulating labor development policies to increase STEM graduates and develop a talent stream for advancing 6G technologies.

10. Recommendations

- 1) The federal government of Germany's devotion to the

open and free Internet and international efforts to protect international infrastructures is commendable. However, it should take on more international responsibility to create a society-oriented digital evolution. The federal government should exhibit even more global leadership in shaping and defining, proactively, novel technological futures for contemporary societies.

- 2) Global policymaking should create a new digital society that supersedes market-based patterns.
- 3) Data governance should be perceived along societal rather than market needs for secure transnational streams only. This means acknowledging the key role of data regulations in organizing power structures and societies.
- 4) Show more ambitious commitment to creating different digital public spaces as required. The current strategy is still deficient in terms of clear commitments and ambition from the government to welcome its role in creating a society-based digital evolution domestically and in the EU.
- 5) Concentrate on a few essential areas to develop a more robust transatlantic digital ecosystem.
- 6) Develop or strengthen mechanisms enabling continuous engagement on novel areas of technology. Prioritize policies on cyberattacks and strengthening cyber resilience. This requires coordinating with the EU to protect consumers and establish the partnerships needed to safeguard societies from hostile forces.
- 7) Hold transatlantic discussions on the enforcement of policies for the European Union's AI Act to determine the compatibility of US and EU regulations.
- 8) The federal government of Germany should conduct continuous regulation and review of AI and emerging technologies.
- 9) Prioritize security of quantum capacities through continuous technology dialogues by, among other measures, imposing export restrictions on specific aspects of quantum computing.
- 10) Intensify technology diplomacy efforts in developing countries and allies.
- 11) Data governance should be much higher on the index of the EU's priorities compared to the past. The EU should work with the U.S. to strengthen consensus in the governance and flow of data beyond the confines of the GDPR.
- 12) Pay more attention to the dangers of deliberate disinformation and the harms caused by digital targeting of users. This is because AI has increased and intensified the threats posed by misinformation and disinformation during important processes such as elections. This should be a key area of partnership between Germany, the United States, and the EU.
- 13) Strengthen transatlantic technological ties, which form the main conduit of digital activities in the world. Undersea data cables traversing the North Atlantic convey

55% more data streams compared to transpacific channels; this confirms its immense potential to create enormous technological and economic gains for Germany, the United States, and EU.

Abbreviations

AI	Artificial Intelligence
CDA	Communication Decency Act
CENELEC	European Committee for Electrotechnical Standardization
DFI	Declaration for the Future of the Internet
DMA	Digital Markets Act
DPAs	Data Protection Authorities
DRC	Democratic Republic of Congo
EARN IT	Eliminating Abusive and Rampant Neglect of Interactive Technologies
EU	European Union
ICANN	Internet Corporation for Assigned Names and Numbers
IMF	International Monetary Fund
IETF	Internet Engineering Task Force
ISO	International Organization for Standardization
ISOC	Internet Society
ITU	International Telecommunications Union
FTC	Federal Trade Commission
GDPR	General Data Protection Regulation
OCPA	Online Consumer Protection Act
ORAN	Open Radio Access Network
PACT	Platform Accountability and Consumer Protection Transparency
PGII	Partnership for Global Infrastructure Investment
PRC	Peoples Republic of China
QED-C	Quantum Economic Development Consortium
QIST	Quantum Information Science and Technology
SNS JU	Smart Networks and Services Joint Undertaking
TTC	Trade and Technology Council
TCPD	Technology Competition Policy Dialogue

Author Contributions

Dr Amos William Omolo is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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