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Reconceptualizing Technological Leadership: A Relational and Dynamic Framework

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Abstract

This article challenges conventional economic-based understandings of technological leadership, which often conflate technological leadership with innovation capability or leading status in the technology sector. Instead, it develops a relational and dynamic framework for understanding technological leadership from an IR perspective. It introduces a novel typology differentiating leadership from leading, and followership from imitation and purchase. Technological leadership is defined as the relational and dynamic process through which a state establishes and sustains influence by setting and enforcing rules, standards, and frameworks that guide innovation and collaboration within a technological ecosystem. The formation of technological leadership is a complex and dynamic process, involving interaction between leaders, followers, and the technological environment, shaped by leadership behaviors, followers' choices, and technological context. This article applies the proposed framework to examine the US–China rivalry for global leadership in artificial intelligence. Through a systematic analysis of AI-related policy documents from both nations spanning the period from 2016 to 2025, the study elucidates how these two major powers have formulated their respective AI leadership strategies and influenced the evolution of global AI governance. The analysis reveals that US leadership in AI is characterized by a dual-focused approach that integrates technological advancement with value-oriented governance, manifesting through three key dimensions: ethical governance frameworks, international collaborative initiatives, and strategic competitive measures. China's leadership behavior, adhering to the principle of mutual benefit, manifests primarily through infrastructure development and standard-setting, adopting a development-centric approach. However, the formation of technological leadership is not solely determined by US and Chinese strategies but is equally influenced by the strategic choices of follower states. Consequently, the ultimate trajectory of the US–China rivalry in AI leadership will predominantly depend on both nations' capacity to attract and maintain follower support.

Keywords
AI governance; leadership theory; norm-building; technological leadership; US–China rivalry

1. Introduction

Technology is an important component in IR (D. W. Drezner, 2019). Scholars argue that technological revolutions can empower economic and military strength, thereby facilitating power transition (Freeman, 1995; Gilpin, 1981; Kennedy, 1987; Porter, 1990). Fast-evolving technology, particularly AI, has fundamentally reshaped the global geopolitical landscape, reflecting the intensifying competition among states for dominance in emerging technological domains. As a result, the concept of technological leadership has emerged a central focus in IR scholarship. However, it is typically assumed that countries with strong innovation capabilities or skills hold technological leadership, and therefore, the focus is mostly on identifying and comparing the factors that drive a nation's innovation capacity (e.g., D. W. Drezner, 2019; Ding, 2024b; Porter, 1990). This perspective, however, remains incomplete. It still does not explain why a country with strong technological advancements, such as China, with its 5G and Deepseek technologies, faces bans from many other countries. In this context, does the country holding the technology possess leadership, or is it the banning country (the US) that holds the leading power? Also, what constitutes true technological leadership in the context of global power dynamics?

Existing research on international political leadership has predominantly focused on macro-level analyses, emphasizing broad power structures, hegemonic transitions, and the role of major states or institutions in shaping the global order (Ikenberry, 2001; Keohane, 1984; Nye, 1990; Schweller & Pu, 2011; Yan, 2011). While these studies provide valuable insights into the distribution of power and the dynamics of international relations, they often overlook the intricate and context-specific mechanisms that define leadership within specialized domains. As Nye (2011, p. 231) states, in a global information age, power is becoming more diffuse, and leadership is becoming more contextual. No country can dominate across all issues, and the ability to exercise power depends heavily on the context of the situation. The logic of leadership varies significantly across different domains. Against this backdrop, this study focuses on technological leadership, a domain that has become increasingly central to global power dynamics in the digital age.

This research seeks to address this question by challenging the conventional economic-centric view of technological leadership, which equates leadership with innovation capability or market dominance. Instead, we propose a relational and dynamic framework for understanding technological leadership, emphasizing the interplay between leaders, followers, and the technological environment. Drawing on leadership theory (Burns, 1978; Nye, 2008), we argue that technological leadership is not merely about being ahead in innovation but about the ability to set and enforce rules, standards, and frameworks that guide global technological ecosystems. This framework shifts the focus from static measures of technological capability to the dynamic processes of influence and norm-setting in international relations.

This article contributes to the existing literature in three ways. First, it offers a novel conceptualization of technological leadership as a relational and dynamic process, distinct from mere technological capability. Second, it highlights the issue-specific nature of leadership, allowing for a nuanced comparison of US and Chinese strategies in AI governance. Third, it underscores the importance of follower choices in determining the success of leadership strategies, as nations align with the model that best serves their national interests. Via examination of the US–China rivalry for global leadership in AI, this article sheds light on the broader implications of technological leadership for global governance and power dynamics in the 21st century. By integrating conceptual clarity, theoretical innovation, and empirical analysis, this study aims to advance scholarly understanding of technological leadership and its implications for global power dynamics.

Technological leadership, while a critical subject of inquiry, is conceptually ambiguous and demands rigorous examination. Therefore, this article begins by addressing these foundational conceptual issues, drawing on the existing literature to interrogate and refine the definition of technological leadership: What constitutes technological leadership, and how can it be systematically distinguished from related concepts such as technological dominance or innovation capacity? Building on this conceptual groundwork, this article introduces an alternative relational and dynamic conceptual framework, distinguishing between leadership and mere technological capability. We then apply this framework to the US–China rivalry for global leadership in AI, analyzing how each country mobilizes leadership through governance strategies, regulatory frameworks, and geopolitical alignments. Finally, this article concludes by summarizing key findings, discussing implications for global technological competition, and outlining avenues for future research.

2. Economic Centric Approach of Technological Leadership

Early discussions of technological leadership emerged in the context of public policy and management studies, often equating it with a country's or firm's ability to lead technological innovation and investigate whether it will contribute to a country's economy. Scholars such as Freeman (1987, 1995) emphasize the role of national innovation systems in fostering technological leadership, highlighting the interplay between government policies, corporate R&D, and educational institutions. In this view, technological leadership was primarily understood as the ability to produce and commercialize cutting-edge technologies, giving states or firms a competitive edge in global markets. Technological leadership, then, is often measured or evaluated through four factors: R&D intensity, R&D inputs and outputs, number of scientific publications, and patents (Huang & Sharif, 2016). R&D related data, market share in leading sectors, and other economic growth indices have been widely used as evidence of the rise and fall of British, American, and Japanese technological leadership (Kindleberger, 1961; Kranzberg & Pursell, 1967; Maddison, 1982; Mokyr, 1990).

From the international political economy perspective, Gilpin (1981) argues that a country's dominance in key leading technological sectors drives significant economic and political advantages, sustaining an empire or hegemony. However, the loss of technological dominance, i.e., the transfer of advanced techniques from more developed societies to less developed ones, especially in modern society, is a key driver of the redistribution of power in an international system (Gilpin, 1981, p. 180). Compared with Gilpin's emphasis on maintaining dominance over key technology, long-cycle theorists (e.g., Modelski, 1987; Modelski & Thompson, 1988; Thompson, 1990) suggest a cyclical nature of global power transitions driven by technological innovations. The rise and fall of power may depend on the same technology, driven by its breakthrough, diffusion, and eventual decline. Thus, the future of global leadership will depend on which countries and sectors lead the next wave of technological innovation.

Much of the subsequent literature follows suit by identifying and comparing factors contributing to technological innovation within great powers. Some focus on the domestic institutions. Olson (1982) finds that political stability forms special interest groups that pursue narrow, rent-seeking goals, therefore hindering innovation. D. Drezner (2001) argues that decentralized state structures are better at fostering innovation and maintaining hegemony because centralized systems are more likely to make errors, which cannot be reversed at the local level. Focusing on Japan's success, Kitschelt (1991) argues that rather than imposing a successful formula, the industrial governance structures need to match the properties of new technologies to achieve innovation success. Rosenberg (1992) argues that innovation is unpredictable, and no single entity can foresee which technologies will succeed. He therefore suggests that a system with multiple, independent experiments is more likely to uncover successful innovations.

Scholars' interest in technology innovation is not only in leading sectors, but also in the diffusion of technology. Challenging the conventional wisdom of monopolizing innovation in new, fast-growing industries (leading sectors), Ding (2024b) argues that general-purpose technologies (GPTs) are foundational innovations that enhance economic productivity after a lengthy process of spreading across various sectors. He argues (Ding, 2024a, p. 190) that "innovation laggards can be diffusion leaders" and compared with the US, China has limited capability to transform new technologies into standardized products across various sectors. In contrast, its diffusion efforts may be more focused on market-seeking strategies (Huang & Sharif, 2016). Huang and Sharif (2016) argue that, compared with the US, China has an edge in technological leadership from its big domestic and overseas markets and low-cost forms of innovation (Losacker & Liefner, 2020).

Though the concept of technological leadership has been widely discussed, there are limitations within the technological leadership literature. First, technological leadership is similar to hegemonic leadership literature, which emphasizes the capabilities of a country rather than its relational influence. Relying on its unprecedented structural material capacity, a hegemon can exert influence on other countries (Russett, 1985; Strange, 1987). Similarly, by relying on its technological capabilities (including a monopoly on leading sectors, diffusion transformation capability, market resources, and R&D or patent outputs), a country can set the norm to influence other countries. However, it does not explain why Huawei technologies, with its cost-effective performance, has been banned by the US, a ban that has since been followed by many other countries.

Second, the existing technological leadership may conflate the supplier-customer and creator-imitator relationship with a political mobilization relationship. Much of the literature or policy papers frame the US–China tech-rivalry in competing for technological leadership, because China accesses many overseas markets, implying China possesses strong technological leadership (e.g., Wu, 2024). Or when countries or companies imitate the advanced competitors' products, the advanced competitors hold strong leadership. We argue that the commercial relationship does not equate with the power of mobilization, i.e., technological leadership. Whether a country holds technological leadership depends on whether a norm is set and whether followers accept the norm.

Third, the existing literature, especially literature on great powers' global leadership, tends to treat technology as a subordinate element of the economy. Given that technology empowers economic and military strength, we would expect that technological leadership will go hand-in-hand with leadership in other domains, contributing to the overall global leadership. However, the US's ban on China's technology may suggest that technological leadership may harm its liberal economic leadership and its global leadership overall (Ryan & Burman, 2024).

3. A Relational and Dynamic Framework of Technological Leadership

We follow a relational and dynamic leadership concept from the prevailing leadership literature, which has predominantly focused on the dynamic interplay between leaders and followers within contexts (Avolio et al., 2009; Hollander, 1992; Northouse, 2021). Leadership is not a fixed national attribute defined solely by a country's capacity to innovate, nor is it—following Burns' critique—merely the exercise of authority to compel compliance (Burns, 1978, p. 19) or the manipulation of followers to serve the leader's interests (Burns, 1978, p. 449). It is closer to Nye's (2008, p. xi) concept, "a social relationship with three key components": leaders (individuals or entities with positional or personal influence), followers (those who choose to align with or respond to leadership), and the domain of interaction (the specific issue, task, or context in which leadership is exercised). We see leadership, at its core, as a relational and interactive process that involves influencing others to achieve shared goals in a specific context.

While the broader leadership literature offers a clear and well-developed understanding of leadership as a relational and dynamic process, the technological leadership literature often deviates from this foundation, conflating leadership with being ahead and imitation/procurement with followership. To address these conceptual misunderstandings, we begin this section by analysing how leadership and followership are commonly misrepresented in the technological domain. We then summarize these issues into a nuanced framework, presented in Figure 1, which distinguishes between different behavioral patterns associated with leadership and followership. Building on this clarification, we introduce our conceptualization of technological leadership and explore the key factors that shape its interdependent components.

From the leader's perspective, the difference between leading and leadership is often overlooked, with technological advances mistakenly seen as leadership. Leadership is about fostering mutual purpose and aligning the values and motivations of both leaders and followers, rather than merely exercising a leading advantage. In contrast, being ahead, whether in technology, market position, or innovation, is often a result of competitive advantage or resource superiority, which does not inherently involve the relational and motivational dimensions that define true leadership. An Olympic champion, by virtue of their exceptional athletic abilities and skills, may achieve a leading position in their sport, but this does not inherently make them a leader among their competitors. For example, Usain Bolt, widely regarded as the fastest sprinter in history, dominated the 100-meter and 200-meter events for over a decade, setting world records and winning multiple Olympic gold medals. However, fellow competitors will not regard him as their leader. In another case, Sebastian Coe is a two-time Olympic gold medalist in the 1500 meters (1980 and 1984). He became President of World Athletics and chaired the London 2012 Olympic Games Organizing Committee. In these roles, he has driven reforms to strengthen the sport's integrity, promote gender equality, and shape its future (Salguero, 2024). Coe's journey illustrates that leadership involves leveraging influence to inspire change and leave a lasting impact—not just individual success.

Microsoft, once known for dominating personal computing through products like Windows and Office, was often criticized in the 1990s and early 2000s for its monopolistic practices and limited collaboration with the industry (Cusumano, 2004). This changed under CEO Satya Nadella from 2014, who shifted Microsoft's focus from competition to broader industry leadership. Key initiatives include: (a) embracing open-source platforms like GitHub and supporting collaborative innovation (Microsoft, 2018); (b) expanding Azure to lead in cloud computing, which competes directly with Amazon Web Services and sets standards for cloud security, interoperability, and sustainability; and (c) promoting ethical AI and accessibility through initiatives like AI for Good, which tackles global challenges by expanding access to digital skills, supporting education, and collaborating with researchers to develop impactful solutions, highlighting Microsoft's commitment to societal benefit (High, 2025). This transformation shows that while innovation drives technical success, it is not a necessary and sufficient condition for forming technological leadership; shaping standards and fostering collaboration matter too.

In the 19th century, Germany emerged as a dominant country in the global chemical industry, driven by strong academic-industrial collaboration, breakthroughs in organic chemistry, and innovations in synthetic dyes and pharmaceuticals (D. Drezner, 2001; Moe, 2007). However, Germany's chemical production model—which relied heavily on highly trained chemists and artisanal batch processes—did not diffuse widely to other nations. Instead, it was the US that institutionalized the discipline of chemical engineering, thus becoming the global leader in the chemical sector (Ding, 2024a, 2024b).

From the follower's perspective, treating imitation or purchase as a behavior of following is also problematic. Rogers (2003) regards innovation diffusion as a process through which an innovation spreads within a social system. Products spread and are adopted by more individuals and organizations. They gradually achieve market share. Market share is therefore used as a metric to demonstrate a country's economic and technological leadership, because it may reflect consumers' acceptance and shifted market dynamics. However, the act of purchasing a product does not imply that the consumer is aligned with or willing to follow the seller's vision or direction. Similarly, imitation is also not followership. According to a Levitt (1966), innovative imitation is a strategic choice for companies. When new and successful technology emerges in the market, other companies may imitate it to keep up with the competition. However, it also does not mean that imitators follow the vision of those they imitate. For example, during the mid-20th century, Japan actively engaged in imitating American technology, particularly in key industries such as automotive manufacturing and electronics. Japanese companies like Toyota meticulously studied American production techniques, including Ford's assembly line system, and even imported American machinery to replicate their processes (Womack et al., 1990). However, Japan's objective was not to follow the US as a leader; rather, Japan surpassed it. By embracing kaizen (continuous improvement) and focusing on innovation, Japanese companies transformed imitative technologies into superior products. Moreover, Japan redefined global standards in the automotive manufacturing and electronics industries.

Figure 1 summarizes the above arguments and offers a nuanced framework for distinguishing behaviors associated with technological leadership at the state level. Much of the literature illustrates behaviors in the right panel, which are essentially non-relational, competition-oriented, and detached from power-based dynamics. A country with a strong technological capability is leading *per se* in terms of its products, but not necessarily relationally engaged with other countries, as is the case for Germany and the US. Conversely, a country with weak technological capabilities may imitate or acquire technologies from a more advanced country, but the engagement is non-power-based, because weak countries do not necessarily follow the leading countries' vision or standard. Furthermore, it is a competition-oriented relationship, mostly driven by the market. Imitators may replicate technologies or business models to capture market share; procurers may adopt these innovations to strengthen their own capabilities. Despite the innovation inspired by competition, it creates an environment where alliances are fluid, unstable, and temporary, and rivalries are prevalent.

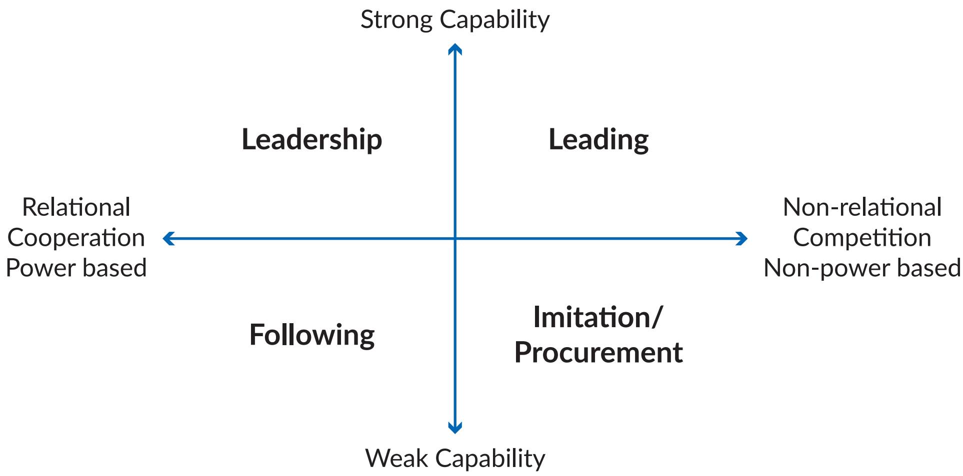

Figure 1. Behavioral typologies in the technology sector.

Technology leadership is fundamentally a collaborative and power-based relationship between leaders and followers, as seen in Figure 1's left panel. Leaders provide public goods such as technological standards, an innovation framework, and market stability, which benefit both themselves and their followers. In return, followers align with leaders, contributing to the ecosystem's growth while relying on the leader's direction and resources. In the technology sector, leaders must also offer value creation to sustain their influence. This includes access to cutting-edge technologies and collaborative platforms that enable followers to innovate and compete effectively, rather than preventing competition from the followers. As noted in the previous case, Microsoft provides open-source tools, cloud infrastructure, and developer ecosystems that empower smaller firms and startups, strengthening its role as a technological leader. In short, the right panel portrays a leading entity's static technological capability, and adopts a fluid and unstable competition driven by the market, while the left panel shows an interdependent structure and a relational and dynamic process. A state leader builds and sustains influence by setting norms and shaping standards to encourage collaboration and innovation. It aligns followers with shared goals, provides public goods like technological infrastructure and market stability, and fosters cooperation while maintaining a power-based yet mutually beneficial relationship with stakeholders.

Given that country's technological leadership is a complex and dynamic process shaped by interactions among leaders, followers, and the technological environment, we dissect it into core components: the leader's fundamental qualities and behaviors, the choices of followers, and the influence of the broader technological context. These elements interact and shape one another, collectively driving the formation and evolution of technological leadership. We analyze each in detail in the subsequent paragraphs.

Regarding states' leadership behavior, we argue that it is determined by technological capability and internal drive to lead. Innovation is the core driver of technological advancement. A state's innovation ability enables the creation of new technologies and enhances the evolution of current technologies, granting the state the potential to shape the broader technological ecosystem. States often face a dilemma: whether to protect their technological advantages by keeping innovations proprietary or to open their technologies to promote global standards, even at the risk of economic loss. While protecting innovations may secure short-term competitive advantages, openness can establish long-term leadership and influence. Ultimately, a state's internal drive for leadership is to maximize its national interests, encompassing not only short-term economic benefits but also long-term considerations such as strategy, security, geopolitics, and global influence. A country will assume leadership when it believes this will safeguard its national interests.

State leaders establish their technological leadership not only through technological superiority but also by leading behaviors such as setting rules, providing public goods, and shaping a compelling vision for the future. Their influence depends on creating value and profit for followers, thereby fostering a collaborative and sustainable ecosystem. By setting technical standards and industry norms, they embed their technologies and values into the international order, securing long-term strategic influence. They also supply public goods, including technological infrastructure, innovation platforms, and an open market, to attract followers' collaboration. Additionally, these leaders inspire collective action by promoting visions aligned with global challenges and opportunities, attracting followers with similar goals and values.

As leadership is a relational process, it cannot only be formed by leaders. The choice of following countries is also important in technological leadership. We argue that it is influenced by technological and economic interests, and political and security considerations.

First, following countries need to balance their technological needs with economic interests when deciding on cooperation. Technological requirements often dictate the scope of engagement with leading countries. Developing countries seek partnerships with technologically advanced countries to bridge the technological gap. China, with its rapid advancements and cost-effective solutions, has become an attractive partner for many developing nations. The *Digital Silk Road* initiative exemplifies this dynamic. Southeast Asian countries choose to follow China in this framework to modernize their digital infrastructure, including high-speed broadband networks and data centers (Mochinaga, 2021). Economic interests, such as market access and investment opportunities, are also crucial. The EU, while economically advanced, recognizes the strategic value of partnering with the US in technology. Such collaborations offer access to American capital and markets, enabling European tech firms to expand operations, boost revenues, and improve competitiveness globally.

Second, political interests and security concerns shape followers' decisions. Strong political alliances often drive collaborative efforts, as shared strategic interests create a foundation of trust and mutual benefit. For example, Japan, as a key ally of the US, actively engages in joint technological initiatives, especially in emerging fields like quantum computing. This cooperation is propelled not only by technological and economic considerations but by shared political interests. Nations may distance themselves from leading powers if there are conflicting political or security interests. For example, countries opposing a leader's political or economic policies might avoid collaboration to prevent being perceived as aligned with that leader's political ideology. Such tensions can hinder technological and economic cooperation, as broader political objectives outweigh short-term technological gains. Furthermore, technologies like information systems and telecommunications carry both economic and security risks. Follower countries must ensure that their partnerships do not jeopardize national security. In the 5G domain, for example, countries evaluate potential security risks linked to foreign-made equipment and choose partners based on security assurances and reputations for safeguarding sensitive data. The US's campaign against Huawei's 5G technology is a typical example to illustrate political interests and security concerns considered by follower countries. Due to concerns about national security and the potential for Chinese government surveillance, many Western countries, including the UK, Australia, and Canada, have restricted or outright banned Huawei's participation in 5G infrastructure projects. Political and ideological differences between the US and China and national security concerns have thus created a rift in technological collaboration, which will eventually affect European countries' choice, despite Huawei's advancement in 5G innovation and the economic growth it potentially generates for them (Friis & Lysne, 2021; Zhang, 2024).

In short, the technological cooperation choices of follower countries stem from a multi-dimensional evaluation of technological and economic, political, and security factors. Driven by these considerations, while some commit to a single bloc, others might adopt hedging strategies to balance competing interests and mitigate risks. These nations diversify their technological partnerships across multiple leading powers, leveraging each partner's unique strengths while avoiding over-dependence on any single entity. By engaging in simultaneous collaborations with different countries, follower states can protect themselves against potential technological monopolies, political coercion, or security threats. This hedging approach not only serves to safeguard national interests but also enhances diplomatic flexibility, allowing countries to navigate the complex geopolitical landscape of global technology cooperation more effectively. Understanding such strategies is crucial for both followers and leading nations to establish sustainable and successful partnerships, especially in the technology context.

The technological domain differs significantly from traditional interstate leadership due to the rapid evolution and decentralization of innovation, which redefines leadership as more dynamic and adaptive. First, unlike conventional power domains, breakthroughs in AI, quantum computing, and other frontier fields face compressed lifecycles, where temporary advantages (e.g., in blockchain or Web 3.0) can be swiftly overturned. Sustaining leadership thus requires not only continuous innovation but also structural stabilization through regulation, alliance-building, and norm and standard setting. For example, the US has led in AI through advancements in machine learning, natural language processing NLP, and large-scale models. OpenAI's release of ChatGPT in late 2022 showcased this edge. To protect its interests, the US imposed export controls on advanced semiconductors and increased scrutiny of Chinese investment via the Committee on Foreign Investment in the United States (Chan, 2021). Yet China's progress, as seen with DeepSeek, reveals the limits of containment. Its incremental advancements demonstrate adaptive resilience. This underscores a paradox: technological leadership is neither static nor monopolistic.

Second, in the era of Web 3.0, the globalization of technology has enabled more countries and non-state actors to participate in technological innovation, making the leadership environment more decentralized. The rise of open-source technologies, global cooperation networks, and multinational R&D projects has lowered the barriers to technological innovation. The widespread adoption of open-source AI frameworks like TensorFlow and PyTorch has allowed developers and small businesses worldwide to engage in AI research and applications. In such a decentralized leadership environment, leading countries must attract followers through open collaboration and resource sharing, while follower countries have more choices and can select leaders based on their specific needs. This interaction makes leadership relationships more flexible and dynamic. Aligning with Nye's (2011) perception of global leadership stated, no country can dominate all issues in technology in the Web 3.0 era; therefore, the rivalry for technological leadership should be approached as an issue-based inquiry.

4. US and China's Rivalry for Global Leadership in AI

The US–China rivalry in AI has emerged as one of the most consequential geopolitical and technological contests of the 21st century. As AI becomes central to economic growth, national security, and global governance, the stakes of this competition continue to rise. Both countries have explicitly expressed their goal of developing or sustaining global leadership, providing an opportunity to examine our leadership framework.

This section analyzes how the US and China pursue global AI leadership, based on their AI-related policy documents between 2016 and 2025. Our analysis begins with each country's domestic strategic priorities and implementation mechanisms, which serve as the foundation for its global leadership. We then examine how these domestic foundations shape their international engagement, particularly in efforts to influence global AI governance and followers. Lastly, we illustrate followers' responses towards two countries.

The US and China are actively promoting different visions of AI leadership, each seeking to align the global ecosystem with their strategic interests and values. To understand this rivalry, it is important to recall the conceptual framework, which emphasizes that AI leadership goes beyond mere technological breakthroughs in algorithms, computing power, or data collection. It also involves defining the rules of the game—setting the norms, standards, and ethical frameworks that govern AI's deployment, development, and regulation. We present their different versions of AI leadership in a comparative approach. In summary, the US leads in AI by fostering a collaborative, values-based ecosystem grounded in innovation, open-source platforms, public-private partnerships, and multilateral cooperation, while China pursues a state-led, infrastructure-anchored, and development-embedded model of AI leadership. The US mostly attracts its democratic allies, such as the EU countries, while China's leadership is followed by many developing countries in need of infrastructure and development.

The US has cultivated its AI leadership through establishing a technological ecosystem that exemplifies the collaborative model of technology governance. Rather than pursuing unilateral dominance, the US has established itself as a system leader by providing key public goods that simultaneously strengthen its position while enabling broader ecosystem participation. The US seeks to balance its national interests with the values and expectations of other countries. This approach manifests in three interlocking dimensions that create a self-reinforcing leadership structure: enhancing strong innovation capability, multilateral cooperation, and relational governance through leveraging multilateral institutions to shape global AI norms and standards.

First, the US leads in AI through public-private partnerships and deregulatory policies that sustain its competitive edge, forming the domestic foundation for exercising global leadership. Rather than directing, the US fosters an innovation ecosystem where federal coordination supports private sector dynamism, with global tech giants driving progress under a light-touch regulatory model (Bradford, 2023) and combining it with market-driven agility. A key institutional mechanism is the National Science and Technology Council's Subcommittee on Machine Learning and AI, established in 2016 to align federal research efforts and streamline cooperation across sectors. This laid the groundwork for the National Artificial Intelligence Research and Development Strategic Plan, which advances three priorities crucial for global leadership: long-term research investment to maintain technological advantage, ethical frameworks to ensure social license for innovation, and multi-stakeholder governance to mobilize resources from industry, academia, and government (US National Science and Technology Council, 2016). These domestic arrangements serve not only to bolster US competitiveness but also to lay the foundation for its global AI leadership, particularly in setting international norms and standards.

Second, the US is providing an international public good by using open-source platforms and ethical frameworks in its leadership strategy. The US government collaborates with the private sector and supports open-source AI platforms, such as TensorFlow (developed by Google) and PyTorch (developed by Meta), allowing anyone (including other countries) to participate. The practice (such as in the Blueprint for an AI Bill of Rights) helps establish de facto technical industry standards, including fairness, transparency, accountability, and privacy (White House Office of Science and Technology Policy, 2022), enabling worldwide access to building and deploying AI models efficiently (High, 2025; Microsoft, 2018). Building on these efforts, the US has played a leading role in shaping international AI governance, exemplified by its key contribution to the 2019 Principles on Artificial Intelligence of the OECD, which emphasize human-centric AI, transparency, and accountability. By actively engaging with its allies, the principles of the US have been adopted by over 50 countries (OECD, 2020). Furthermore, the US is actively setting up ethical framework initiatives such as GPAI and the US–EU Trade and Technology Council to lead in the global AI governance.

Third, in a relational way, the US is strategic and selective in mobilizing its potential followership and seeks to shape the global evolution of AI in a manner that aligns with its economic and national security interests. The US adopts a dual-track policy that can be summarized as open to its followers but decoupled from its competitors. Trump notes at the beginning of the *American Artificial Intelligence Initiative* that "continued American leadership in AI is of paramount importance to maintaining the economic and national security of the United States and to shaping the global evolution of AI in a manner consistent with our Nation's values, policies, and priorities" (Office of Science and Technology Policy, 2020, p. 1). The EU is an important partner. At the G7 and G20 summits, the US promoted shared AI governance frameworks to coordinate with its democratic allies, and the EU engaged with these efforts. Through bilateral science and technology agreements, such as those with the UK and France, the US fostered collaborative R&D efforts and helped set common standards for AI development (Khasru et al., 2025). However, it needs to be noted that the EU is also advocating its own version of AI governance, spearheading regulatory frameworks that prioritize ethical principles, fundamental rights, and accountability. The EU issued the EU General Data Protection Regulation, aiming to offer EU citizens a harmonized approach towards privacy, emphasizing people's rights to data protection. The Artificial Intelligence Act entered into force in August 2024, aiming to promote human-centric, trustworthy, and sustainable AI, while protecting individuals' freedoms and rights. However, while the EU's framework is innovative and rigorous, its influence remains largely confined to its own jurisdiction, as few non-EU nations truly follow the EU's model. The EU lacks the capability to diffuse its standards and norms to make its normative model a tool to build relational partnerships with other nations; therefore, we may regard the EU as leading in terms of AI ethical regulation, but without followers, we cannot perceive it as a leader. By highlighting shared interests in AI governance, the US fostered alignment with the EU.

In response to its competitors, the US also prioritized partnerships to counter authoritarian AI models, leveraging multilateral forums to advance its regulatory principles. The US includes strategic competition as a core component of its international leadership, integrating national security imperatives into its global strategy. *The National Security Commission on Artificial Intelligence Final Report* (2021) highlights the need to counter adversarial nations, particularly China, by advancing AI capabilities in defense and cybersecurity. On February 21, 2025, the Trump administration signed a memorandum instructing CFIUS to restrict Chinese investment in certain strategic areas. In short, the US leadership in AI is characterized by a technology-and values-driven approach that integrates ethical and technological governance, international collaboration, and strategic competition. These combined efforts not only reinforce the US's global leadership but also aim to build a more equitable and secure AI ecosystem aligned with democratic values and national interests.

In contrast, China's global AI leadership is advanced through national development plans, efforts to combine AI standardization within national economic transformation and social governance, and large-scale digital infrastructure investment. First, China's AI global leadership is rooted in a domestic long-term strategic vision, exemplified by the Next Generation Artificial Intelligence Development Plan (The State Council of the People's Republic of China, 2017). The plan sets clear milestones and shows a state-led leadership style. It outlines three stages: achieve global parity and integrate AI into key sectors such as healthcare and education by 2020; make major breakthroughs in AI theory and applications, driving economic transformation and establishing China as a global AI innovation hub by 2025; and become the world's primary AI innovation center, leading in theory, technology, and applications, with AI as a core driver of economic and social development by 2030. The plan's strategic priorities are on foundational technology breakthroughs, open AI platforms, infrastructure and ecosystem development, and international collaboration, actively promoting global cooperation and participation in setting international AI standards to strengthen China's role in global AI governance (The State Council of the People's Republic of China, 2017).

Second, building on this, China integrates AI technology within broader socio-economic development and infrastructure objectives, aiming to establish ethical and legal norms that support the sustainable development of the AI ecosystem. This can be clearly observed in China's AI policy shift, which previously emphasized technology catch-up and talent cultivation. The White Paper on Artificial Intelligence Standardization (2018–2023; China Electronics Standardization Institute, 2018) shows this transition—from an early focus on building a technological foundation through R&D and talent development to a more integrated approach that combines AI development with national priorities. As AI applications grow, the emphasis has shifted toward standard-setting in data, algorithms, and system interoperability to strengthen domestic market health and boost international influence. The latest version framework embeds AI into broader goals of economic transformation, improved social governance, and public welfare—particularly in areas like smart cities, healthcare, and environmental protection—underscoring China's emphasis on sustainable and socially embedded AI development.

Third, China's AI strategy, which integrates development and infrastructure, is central to its global leadership approach and has attracted and mobilized followership, particularly among developing countries seeking digital and AI infrastructure, while embedding Chinese-led AI standards into these systems. China's Digital Silk Road reflects this strategy by using infrastructure investment to forge durable technological and geopolitical alliances. By offering a comprehensive package that combines affordable financing, technology transfer, and strategic political alliances, China has institutionalized collaboration and has attracted numerous developing countries to follow its lead in digital development. The Digital Silk Road, launched in 2015, has over 130 projects under Belt and Road Initiative's label (Russel & Berger, 2021). The initiative advances China's leadership through three main goals: achieving interconnection and interoperability of digital infrastructure among participating countries, creating a new form of digital economy driven by data elements, and establishing clear-cut digital governance rules (He & Zhou, 2024). China acts as a provider of infrastructure, institutions, and ideas—constructing data centers and smart cities in Kenya, fiber-optic networks in Pakistan, and 5G testing in Thailand. Technologies from Chinese firms like Huawei and ZTE are widely adopted in countries such as Malaysia, Ecuador, and Kenya, improving digital capacity in local areas. China also promotes its technical standards through bilateral agreements, signing over 90 with 52 countries by 2019 (Russel & Berger, 2021), and integrates these standards into foreign projects to support trade and industrial cooperation (The State Council of the People's Republic of China, 2015).

In summary, the competition between the US and China in AI governance extends beyond technological advancement to the establishment of international norms and technical standards. Both nations, based on their domestic foundation, have actively promoted their respective frameworks, seeking to shape the global AI ecosystem in ways that reflect their strategic interests and values. Especially, the US's framework promotes open ecosystems and ethical norms, while China focuses on building infrastructure and exporting its technology and standards, particularly to developing countries. This competition is particularly intense in areas such as data governance, algorithmic transparency, and AI ethics, where the stakes are high due to AI's transformative impact on economies, security, and societal structures.

However, the above comparison still largely focuses on countries' leading strategies without necessarily emphasizing followership and a relational process. The ultimate establishment of leadership in AI also hinges on followers' perceptions of which model provides greater benefits to the preservation of their national interests. The unique nature of the AI environment, characterized by rapid technological change, data dependency, and geopolitical competition, amplifies the importance of follower choices. The fragmented nature of the global AI ecosystem, characterized by differing regulatory environments and technological capabilities, means that follower nations will choose based on their specific needs and priorities, driven by either political and security considerations or technological and economic interests.

The EU aligns with US AI leadership primarily due to shared security interests. While the EU positions itself as a regulator of AI ethics and promotes "strategic autonomy," its actual AI development remains deeply intertwined with a US-led framework. Its member states often align with US AI strategies on political and security fronts, especially within NATO and transatlantic defense partnerships. For instance, EU members (e.g., France and Germany) participate in US-led military AI projects, such as NATO's AI strategy and drone surveillance systems. Despite advocating for "digital sovereignty," the EU has *de facto* aligned with US export controls on AI-related technologies to China.

Serbia's embrace of Chinese AI technologies, especially in smart city infrastructure and surveillance, is motivated by economic and technological needs. Serbia needs affordable and advanced AI solutions; China is willing to provide financing and technology transfer. For instance, Chinese companies like Huawei have deployed facial recognition and surveillance technologies in Serbia, aligning with the country's goals of modernizing its infrastructure (Russel & Berger, 2021). The adoption of Chinese AI technologies has accelerated Serbia's digital transformation. Projects like the Belgrade Smart City initiative, powered by Chinese technology, have improved urban management and public safety. Chinese financing terms, technology transfer packages, and implementation speed address Serbia's immediate developmental needs more effectively than Western alternatives. This case highlights the infrastructure-for-influence dynamic in the AI sector.

Singapore provides a compelling example of a nation that has adopted a pragmatic hedging approach, aligning with both the US and China in different areas of AI technology and governance. Singapore has adopted the US-led ethical AI framework in areas such as data governance and algorithmic transparency. For instance, Singapore's Model AI Governance Framework, released in 2019 and updated in 2020 and 2024, aligns closely with the OECD AI Principles and the US Blueprint for an AI Bill of Rights. These frameworks emphasize fairness, accountability, and transparency in AI systems, reflecting Singapore's commitment to building trust in AI technologies (Personal Data Protection Commission & Infocomm Media Development Authority, 2020). In 2023, Singapore launched the Singapore National AI Strategy 2.0 (NAIS 2.0), in which infrastructure and environment are one of the key systems of Singapore as a smart nation (Government of the Republic of Singapore, 2023). To that aim, Singapore has adopted Chinese AI technologies in areas such as smart city infrastructure and surveillance systems. For example, Singapore has collaborated with Chinese tech giants like Huawei and SenseTime to implement AI-powered surveillance and facial recognition systems as part of its Smart Nation Initiative. These technologies are used to enhance public safety and urban management, aligning with Singapore's goals of becoming a global leader in smart city development (He & Zhou, 2024). This dual-alignment approach reflects Singapore's pragmatic strategy of maximizing benefits from both models while maintaining its own technological sovereignty and economic interests. Singapore's case illustrates that follower nations do not have to choose exclusively between the US and China. Instead, they can adopt a pragmatic, context-specific approach that aligns with different aspects of each model based on their strategic priorities. Singapore is leveraging its followership as a strategic resource—the ability to access and synthesize multiple systems to develop its own AI governance and leadership in the region. In short, the ultimate determination of the US–China rivalry of AI leadership will depend on the ability of the US and China to attract and retain followers by offering tangible benefits. The US appeals to nations prioritizing ethical governance, democratic values, and individual rights, as seen in the EU's alignment with US-led frameworks. In contrast, China's emphasis on affordable technology, infrastructure development, and economic growth resonates with developing nations like Pakistan and Serbia. Meanwhile, pragmatic followers like Singapore demonstrate that nations can strategically align with both models, leveraging the strengths of each to address their unique needs.

5. Conclusion

This article has developed a relational and dynamic framework for understanding technological leadership, emphasizing the interplay between leaders, followers, and the technological environment. Unlike traditional approaches that conflate leadership with innovation capability or market dominance, our framework highlights the importance of norm-setting, rule-making, and the ability to inspire collective action within global technological ecosystems. Through this lens, we have analyzed the US–China rivalry in AI, revealing how both nations are vying to shape the global AI governance landscape in ways that reflect their strategic interests and values. The ultimate outcome of the US and China rivalry for AI leadership will depend on the ability of the US and China to attract and retain followers. The US appeals to nations prioritizing ethical governance, democratic values, and individual rights, as seen in the EU's alignment with US-led frameworks. In contrast, China's emphasis on affordable technology, infrastructure development, and economic growth resonates with developing nations like Pakistan and Serbia. Meanwhile, pragmatic followers like Singapore demonstrate that nations can strategically align with both models, leveraging the strengths of each to address their unique needs.

AI significantly amplifies the challenges for leaders. In the AI field, it is extremely difficult to maintain long-term and comprehensive leadership. The dispersive nature of leadership in AI is determined by the characteristics of this fundamental leadership context. AI is a rapidly evolving and complex technology. The speed of innovation means that any advantage a leader may have can quickly be eroded. The widespread adoption of open-source technologies and the increasing number of players in the AI field have decentralized the power structure. This decentralization makes it challenging for leaders to exert absolute control and maintain their position over an extended period. Looking ahead, both the US and China are likely to continue leveraging their technological advantages to establish more norms and standards in AI governance. However, AI governance remains a nascent space, and building international consensus will be critical to addressing the risks and uncertainties of AI development.

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