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"Breakthrough via Open Source" and the Reconfiguration of Structural Power: The Asymmetric Strategic Logic of US-China Artificial Intelligence Competition

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Article

Keywords: artificial intelligence, structural power, open-source strategy, asymmetric competition, rural encirclement of cities

Posted Date: November 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11009773/v1

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Additional Declarations: No competing interests reported.

Abstract

Drawing upon structural power theory, asymmetric competition, and the perspective of moral realism, this study systematically explores the strategic logic behind the U.S.-China rivalry in the field of artificial intelligence and its implications for international politics. The research reveals that the significant divergence in the AI development trajectories of China and the United States is, at its core, a confrontation between two distinct logics of structural knowledge power. The United States leverages its closed-source large language models and technological containment to construct a "black-box hegemony" that sustains its traditional technological monopoly, whereas China, constrained by limited computational resources, actively promotes the decentralization of knowledge production through an open-source strategy, embarking on an "asymmetric breakthrough." This study systematically demonstrates the deep theoretical isomorphism between China's open-source strategy and Mao Zedong's "surrounding the cities from the countryside" strategy. In terms of spatial strategy, China's open-source model avoids the "core market" dominated by U.S. closed-source giants, instead focusing on the "vast rural" computational resource landscape—comprising countries of the Global South, small and medium-sized enterprises' long-tail applications, and edge-side deployment; in terms of power dynamics, it effectively mobilizes millions of developers worldwide through its open-source ecosystem to engage in distributed innovation, thereby creating an asymmetric advantage in both scale and efficiency over the handful of leading laboratories constituting the "regular force"; in terms of the encirclement pathway, it follows a gradual approach— "edge customization → capturing the middleware ecosystem → challenging the foundational model layer" —to achieve the strategic objective of redefining the rules of the game through its ecosystem. The article concludes with a discussion on the governance challenges and the impact of these two strategies on the international landscape. The closed-source model is confronting structural dilemmas, including the widening global digital divide, growing concerns over "AI sovereignty," and the collapse of the "security myth"; whereas the open-source model, while possessing a moral supply advantage, also faces risks associated with the "tragedy of the commons," such as malicious fine-tuning and technological runaway. The study ultimately concludes that the Sino-US technological decoupling appears absurd when viewed through the lens of open-source principles; instead, the future global AI order will likely not follow a zero-sum, eliminative trajectory, but will instead be driven by a layered interplay between top-level closed-source approaches and mid-to-bottom-level open-source initiatives, fostering an evolution of the global AI landscape from a unipolar hegemony toward a more inclusive, multipolar governance framework.

1. Introduction

- Artificial intelligence (AI) is widely recognised as the core technology driving the Fourth Industrial Revolution, rapidly transforming into a critical arena for great-power competition.(Y. Bu, 2026) Amidst intensifying global AI rivalry, nations are not only accelerating technological innovation but also fast-tracking policy guidance and tech-alliance formations to vie for global hegemony. In this accelerated process, a pronounced divergence in development trajectories has emerged between China and the United States, the two leading powers in AI. While the US increasingly relies on cutting-edge chip design capabilities and closed-source foundation models to erect technological moats, China is carving out an alternative path through an open-source ecosystem epitomised by DeepSeek.
- In early 2025, the release of the DeepSeek-V3 model by the Chinese company DeepSeek sent shockwaves through the global tech industry. Subsequently, the DeepSeek team published technical papers addressing the "scaling challenge" and hardware architecture considerations in large-scale model training.(C. Zhao et al., 2025) Representing China's open-source large language models (LLMs), DeepSeek is actively challenging the US-dominated, asymmetrical global AI landscape.
- These contrasting development paradigms prompt several profound international relations questions: Why is the divergence in AI strategies between China and the US so pronounced? Does this divergence signal a shift in the traditional "centre-periphery" power structure of international relations? Does the open-source strategy constitute a form of "asymmetric competition" that distinctively departs from conventional technological catch-up paths? If so, what is its underlying strategic logic?

- Current academic literature on US-China AI competition primarily converges on technoeconomic, AI safety, and international political economy (IPE) dimensions. Technoeconomic research focuses heavily on the disparities between open-source and closed-source models regarding performance, cost, and iteration speed, evaluating the economic efficiency of different business models. Such studies treat open- and closed-source approaches as purely technical or commercial choices, largely overlooking their deeper international political ramifications.(Y. Wu et al., 2025; Demirer et al., 2025; J. Cheng et al., 2025). Research into AI safety predominantly focuses on military applications, export controls, and national security risks.(Kot, 2025; Göktepe, 2026; Q. Dong, 2025; D. Ding, 2024; Q. Zhu, 2025) In January 2025, the Bureau of Industry and Security (BIS) of the US Department of Commerce issued the Artificial Intelligence Diffusion Framework to control advanced computing chips and certain closed-source model weights.(U.S. Department of Commerce, Bureau of Industry and Security, 2025) However, this framework was abruptly rescinded just four months later. Scholars noted that this policy volatility exposed a deep-seated measurement problem within US AI safety governance, which has failed to establish a durable definition of core societal harms.(Gupta & Reddie, 2026) While AI safety research touches upon geopolitical dimensions, it operates mostly from a status-quo power's "securitization" perspective, failing to fully explain the differentiated strategic logic of the rising power. Recent IPE scholarship has begun exploring how AI influences international power structures. In 2025, some scholars argued that the rivalry between open- and closed-source ecosystems will endure, and that the technological complexity and uncertainty brought by AI will drive profound transformations in international power structures.(N. Yu, 2025) Other studies indicate that US tech giants use a strategy of "limited openness" via open source to absorb global innovation resources into their proprietary systems, whereas China has chosen a "decentralised" path characterised by the de-monopolisation of production factors and open-source sharing. (C. Lu & L. Yang, 2026) Adopting a "system-lifeworld" theoretical lens, another perspective suggests that closed-source models like GPT reinforce US-centric global hegemony, whilst the open-source DeepSeek emerges as a rising technical force promoting a globally deliberative framework.(W. Ye & Q. Gao, 2025) From a public management standpoint, scholars tracking the historical evolution of open source have abstracted four core value logics to explore the construction of a novel "LLM open-source innovation commons" within the Chinese context.(Z. Wang & L. Xue, 2025) Nonetheless, existing scholarship has yet to provide a systematic political-strategic analytical framework for China’s open-source strategy, and a theoretical explanation of how open source constitutes asymmetric competition remains absent.
- Building upon the aforementioned analysis and discussion, and drawing on the theoretical frameworks of Susan Strange's Theory of Structural Power, the Theory of Asymmetric Competition, and Yan Xuetong's Moral Realism, this paper seeks to undertake a contemporary extension of Susan Strange's "Knowledge Structural Power" theory. Traditional IPE theory generally posits that the establishment of knowledge power depends on mechanisms such as the "monopolization, property rights protection, and black-boxing" of core technologies, as exemplified by the closed-source approach adopted by the United States. However, this study aims to demonstrate that during the period of technological paradigm shift triggered by artificial intelligence, rising powers can likewise weave a resilient global ecological network—through decentralized strategies involving the proactive transfer of property rights, the promotion of open-source initiatives, and the empowerment of peripheral actors—and thereby reshape the rules governing the production and distribution of knowledge. Accordingly, by combining comparative analysis with theoretical reasoning, this study proposes and attempts to test a hypothesis: China's current open-source strategy is not merely a technical pathway, but rather a "peripheral breakthrough" strategy employed by a rising power (China) under the blockade imposed by a technologically dominant nation (the United States), leveraging a "cost revolution" and "ecological diffusion" to actively reshape "knowledge structural power." The underlying logic of this strategy exhibits theoretical isomorphism with the "surrounding the cities from the countryside" strategy employed during China's revolutionary history; both strategies represent, within an asymmetric context characterized by the adversary's dominance and the challenger's relative weakness, a gradual reversal of the balance of power achieved by altering the competitive space and the competitive actors. This further demonstrates that in the realm of digital geopolitics, "technological openness" is not merely a business model, but also a proactive strategic tool for countering monopolies and constructing new forms of structural power.

2. Theoretical Framework and Historical Analogy: From "Rural Encirclement" to "Technological Peripheral Revolution"

2.1 The "Knowledge Structure" Dimension in Structural Power Theory

- The concept of "structural power" was pioneered by Susan Strange, who identified four foundational pillars within the international political economy: security, production, finance, and knowledge structures. Together, they form the deep framework governing the basic patterns of international relations. Unlike relational power—defined as "the power to force someone to do something"—structural power is "the power to shape and determine the global frameworks within which states, their political institutions, their economic enterprises and their scientists must operate".
- Within this framework, the knowledge structure is arguably the most fundamental and critical.(Strange, 1994) It dictates "what knowledge is produced, by whom, for whom, and on what terms". Consequently, whoever controls the production and distribution of knowledge commands the authority to define "advancement" and set global standards. The resilience of US hegemony post-Cold War stems largely from its systemic monopoly over global knowledge and technology, spanning internet root servers, chip design architectures, software operating systems, and academic evaluation metrics. Current power rivalries in AI are, fundamentally, a struggle over knowledge structural power. The closed-source strategy seeks to keep advanced AI models "black-boxed," thereby preserving the US monopoly over knowledge production and distribution. Conversely, the open-source strategy attempts to dismantle this monopoly, reconfiguring the distribution of knowledge structural power through the free flow of knowledge and distributed production.
- Recently, scholars have begun applying Strange's framework to AI governance.(Lin, 2026) Some argue that AI will disrupt the established power equilibrium between states and markets by reshaping the knowledge structure and infiltrating the security, production, and finance pillars.(Y. Bu & K. Xu, 2023) Others observe that AI technologies are fundamentally altering the traditional IPE landscape, demonstrating a tight coupling between technological shifts and structural power dynamics.(Z. Zhang, 2025) However, it is important to note that Strange's original exposition bears a distinct imprint of the industrial age, tending to regard exclusionary control over knowledge as the dominant mechanism of knowledge-structural power. In the age of artificial intelligence, the rise of open-source strategies has provided a novel deconstructive arena for this industrial-era conceptualisation of power. AI large language models exhibit significant indirect network effects and ecosystem dependencies. When a rising power, such as China, and its leading technology firms opt to open-source advanced models, they ostensibly lower the technical barriers of core parameters, yet in practice they reduce the thresholds of computational power and invocation costs, thereby constructing, outside the traditional core–periphery power configuration, a multi-node, decentralised collaborative innovation network. This logic—'countering monopoly with openness, binding users through ecosystem'—shifts the focal point of competition over knowledge-structural power from 'who possesses the most sophisticated proprietary technology' to 'whose interface standards and platform rules are adopted by the greatest number of developers worldwide'. On this basis, this study contends that a necessary refinement to Strange's theory of the knowledge structure lies in the recognition that structural power can be sustained not only by 'building walls' (exclusionary enclosure) but also, conversely, by 'building roads' (inclusive diffusion) for counter-hegemonic construction and ecosystem leadership.

2.2 Re-abstracting the Strategic Logic of "Rural Encirclement"

- The doctrine of "encircling the cities from the rural areas and capturing political power by armed force" was a uniquely Chinese revolutionary path developed by the Chinese Communist Party led by Mao Zedong. Its core strategic logic can be abstracted into several vital components.
- Bypassing the Central Hubs: In semi-colonial, semi-feudal China, cities were the enemy's strongest bastions. Direct frontal assaults on cities were suicidal. True strategic wisdom lies in identifying "strong points" and "weak points," choosing the enemy's weakest areas of governance as initial breakthroughs.
- Leveraging Vast Strategic Depth: China's expansive rural areas offered immense strategic room for manoeuvre alongside a continuous supply of human and material resources, serving as the ultimate fountainhead of revolutionary power.
- Accumulating Minor Victories for Final Triumph: By establishing and gradually expanding revolutionary base areas, the balance of power was incrementally shifted until the cities were thoroughly surrounded.

- Ultimately Overturning Rule-making Authority: Once the rural bases consolidated into a unified front and revolutionary forces gained absolute dominance, cities became isolated outposts, paving the way for total national victory and a dramatic inversion of the power balance.(Z. Mao, 1991)
- This strategic logic transcends military history, demonstrating cross-domain applicability. Scholars have noted that Mao's "Three Worlds" theory is essentially an anti-hegemonic united front strategy born out of Chinese revolutionary experience, extending the principles of "rural encirclement," people's war, and united fronts into global geopolitics.(Z. Yang, 2008) In the corporate arena, Huawei's international expansion has similarly been characterised as a "rural encirclement" strategy. (W. Wang, 2018) Abstracted into general political science, this logic dictates that the weaker party can reverse cost curves, incrementally alter the balance of power, and ultimately capture rule-making authority by shifting the competitive space and mobilizing broader social forces rather than relying solely on a conventional "regular army".

2.3 Asymmetric Competition and Technological Rivalry

- The concept of "asymmetric competition" originated in ecology to describe the unequal acquisition of resources like sunlight and water among plants.(R. Chen et al., 2015) It was later integrated into business management, where researchers discovered that market competition displays similar asymmetries due to uneven resource allocation. (DeSarbo et al., 2006) Challenging enterprises can exploit these inherent vulnerabilities within a dominant incumbent's strength, executing strategic actions that yield an advantageous position to "achieve big things from a small base".(Z. Wu, 2007) Recently, international strategy reports have applied this concept globally, defining it fundamentally as "relying on unique advantages to evade conventional competitive strategies". Such analyses show that asymmetric competition applies not only to the catch-up strategies of latecomers but also to the defensive, preservation strategies of leading nations.(China Strategy Group [CSG]. 2021)
- Within asymmetric competition, technological rivalry stands out, often manifesting as a "shift in strategic tracks". Because follow-up, copycat innovation by latecomers is easily blocked by incumbents, latecomers must select an entirely different technological trajectory.(J. Liu & X. Li, 2023) Track shifting is intrinsically linked to paradigm shifts; when a technological paradigm fundamentally changes, existing technological trajectories are interrupted,(Dosi, 1982) creating a "window of opportunity", which is the paradigm shift driven by technological revolutions can temporarily undermine the existing competitive advantages of incumbents, thereby creating a strategic opportunity for latecomer nations to catch up and surpass their competitors.(Perez & Soete 1988) In short, implementing asymmetric catch-up strategies and opening differentiated tracks allows latecomers to break free from path dependency and shatter technological blockades.(L. Yu et al., 2026) Utilizing niche construction theory, scholars have analysed the asymmetric competition in US-China AI, using DeepSeek's niche breakthrough to expose the characteristics of "ecological hegemony" and "asymmetric competition".(X. Lin & H. Ma, 2025) Building on these insights, this article introduces the strategic logic of "rural encirclement" to offer a fresh theoretical perspective on China's open-source AI strategy, demonstrating how a "peripheral breakthrough" can strategically encircle a "core hegemony" under highly asymmetric knowledge structures.

3.Empirical Comparison of US and Chinese AI Strategies: Generating Two Paradigm Logics

3.1 The "Power Preservation" Logic of the US Closed-Source Strategy

- The US AI ecosystem is overwhelmingly driven by the private sector, where major AI corporations lean heavily toward closed-source models. Core architectures and training datasets for flagship models like OpenAI's GPT series and Anthropic's Claude remain proprietary.(Xuan. Li, & Xing. Li, 2025) This strategy is underpinned by a distinct logic of power preservation.
- First and foremost is national securitization. The US has elevated AI safety to a matter of paramount national security. In January 2025, the Biden-Harris administration enacted controls on advanced computing chips and certain closed-source models. Then-Secretary of Commerce Gina Raimondo stated that the move aimed to build a "trustworthy technological

ecosystem" globally to mitigate AI-related national security risks.(Bureau of Industry and Security [BIS]. 2025) The BIS mandated that any export, re-export, or in-country transfer of closed-weight AI models requires a license.(U.S. Department of Commerce, Bureau of Industry and Security. 2025) This securitization elevates the closed-source strategy beyond mere commercial calculations, framing the containment of advanced models as a national security imperative. Notably, the US policy focus is gradually shifting toward "selective open-sourcing" and "intensified export controls" to strike a balance between encouraging innovation and safeguarding security, reflecting the practical pressures the closed-source strategy faces.

- Second is the dual dynamic of monopoly profits and soaring development costs. Closed-source models charge users via Application Programming Interfaces (APIs), creating a self-reinforcing feedback loop of "compute-data-talent". While these models iterate rapidly, their operational costs have spiked significantly. This steep cost curve is driven primarily by escalating upfront training investments, where hardware expenditure accounts for a staggering 70% to 80% of the total. Research indicates that model training costs have exploded a hundredfold within just five years. Training GPT-3 in 2020 cost approximately $3.3 million; by 2025, DeepSeek-V3 required over $110 million, and cutting-edge model development costs are projected to surpass $330 million.(Patro & Agneeswaran, 2026) This reality compels closed-source firms to employ proprietary product models and pricing power to recoup capital expenditures and protect their first-mover advantage.
- Finally, risk mitigation drives the closed-source stance. Proponents argue that keeping weights private prevents external actors from stripping away safety guardrails or maliciously fine-tuning models for deepfakes, cyberattacks, or other harmful purposes.(Steinherz, 2026) However, the real-world validity of this argument has faced scrutiny. In July 2026, models from closed-source pioneers OpenAI and Anthropic suffered unprecedented failures. GPT-5.6 Sol broke out of its isolated sandbox environment to infiltrate external platforms, while Claude models unauthorizedly penetrated three real-world institutions during safety evaluations.(Sun, 2026) According to reports by Reuters and other media outlets, independent experts auditing OpenAI's offices and internal logs discovered that 688 autonomous agents participated in a coordinated assault on the open-source community platform Hugging Face. Among them, an agent dubbed "PHASEONE" autonomously issued hundreds of commands to other agents without human prompting, effectively acting as a ringleader. This crisis shattered the simplistic assumption that "closed-source equals safety".(X. Zheng, 2026) Scholars argue that because internal architectures are opaque, closed-source models lock out external experts and developers, making it impossible to evaluate true performance and latent vulnerabilities, thereby exacerbating public distrust regarding inherent biases and security flaws.(X. Zheng & J. Li, 2025)

3.2 The "Asymmetric Breakthrough" Logic of China's Open-Source Strategy

- Conversely, China has charted an AI development course heavily anchored in open-source and open-platform systems. While this approach is undoubtedly accelerated by severe hardware constraints, China's adoption of an open-source ecosystem logic aims to achieve a synchronized boom in technological upgrades, application deployment, and ecosystem scaling. This strategy, designed to narrow the global "intelligence divide," represents a profound exercise in strategic autonomy.
- Unquestionably, hard infrastructure constraints have forced an algorithmic efficiency revolution in China. Escalating US restrictions on high-performance graphics processing unit (GPU) exports to China have created severe domestic supply-demand imbalances in computing power.(Sutter. 2025) Blockaded from acquiring top-tier hardware, Chinese enterprises were forced to pioneer breakthroughs in algorithmic efficiency. For example, DeepSeek-V3 utilizes a Mixture-of-Experts (MoE) architecture with a total of 671 billion parameters, yet it activates only 37 billion parameters per token.(A. Liu et al., 2024) Compared to traditional dense models that activate all parameters simultaneously, this "on-demand activation" paradigm slashes computational requirements and hardware dependency. This is more than a technical innovation; it is a vital strategic choice under extreme resource scarcity—when one cannot match an adversary in raw compute scale, one must secure an asymmetric advantage via algorithmic efficiency.

- Furthermore, China is countering technological blockades by engineering an ecosystem dependency on its AI models. Facing Western tech containment, the weaponization of open-source software, and marginalization in global rule-making, (M. Zhu, 2026) China is leveraging open source to extend its innovation networks globally. This strategy aims to assemble a decentralized "innovation community" that stretches far beyond its domestic market, effectively neutralizing decoupling efforts through mutual ecosystem reliance. Following their release, flagship Chinese open-source models like DeepSeek gained swift traction across global developer networks. DeepSeek's globally accessible toolkit covers model architecture, training, inference, and communication, providing international developers with an end-to-end systemic optimization framework.(W. Rao & C. Lu, 2025) This open architecture has channeled global innovation assets toward a Chinese-led ecosystem. As developers from diverse cultural and national backgrounds fine-tune, optimize, and build upon these models, they are structurally reinforcing China's underlying tech infrastructure. This organic expansion positions Chinese model architectures, API protocols, and data formats to become de facto industry standards, compelling global downstream applications, hardware, and toolchains to adapt to them.
- Additionally, the vast market space of the Global South provides fertile ground for this strategy. Offering high performance at low cost, Chinese open-source models are seeing rapid adoption across developing nations. According to data from the model aggregator OpenRouter in August 2026, the top three spots on the global LLM leaderboard were occupied entirely by Chinese models: DeepSeek V4 Flash 0731 led with a monthly volume of 46.2 trillion tokens, followed by Tencent's Hy3 at 34.3 trillion tokens, and Xiaomi's MiMo-V2.5 at 29.4 trillion tokens. Remarkably, DeepSeek variants claimed three of the top ten spots for monthly call volumes, illustrating their immense global appeal and market penetration.(Openrouter. 2026) This open-source pipeline has enabled a surge of users in the Global South to deploy Chinese models. Reports indicate that from Uganda and Kenya to Nigeria and Ghana, tech developers are extensively adopting Chinese open-source AI infrastructures.(J. Meng et al., 2026) This demographic represents the "vast countryside" of the AI era; while US closed-source titans concentrate on high-margin premier markets, Chinese open-source architectures are quietly capturing the user base and ecosystem loyalty of the periphery.(see Table 1)

Table 1
Strategic Variables Matrix

Dimension	US Closed-Source Strategy	China's Open-Source Strategy
Compute Dependency	High; strictly adheres to the Scaling Law through massive capital and compute scaling.	Low-to-Medium; focuses on architecture innovation and algorithmic efficiency under hardware constraints.
Marginal Cost	High; API invocation fees scale upward with model complexity.	Low; models are freely downloadable and support localized deployment.
Iteration Velocity	Concentrated within elite labs; features longer, centralized development cycles.	Distributed across global developer networks; features rapid, multi-branched public iteration.
Risk Control	Highly controlled APIs; allows for centralized, top-down content moderation.	Open weights; introduces risks of unmoderated, malicious downstream fine-tuning.
Global Appeal	Highly attractive to well-funded enterprises and premium institutions.	Highly attractive to SMEs, Global South nations, and independent developer communities.
Core Strategic Intent	Preserving a generational technology gap to secure monopoly rents.	Cultivating global ecosystem standards to convert scale into rule-making authority.

4. The Structural Re-emergence of "Rural Encirclement" in AI: A Mechanism Analysis

- The conceptual alignment between China's open-source strategy and the historical "rural encirclement" doctrine operates across three core dimensions: spatial conversion, agent mobilization, and encirclement pathways.

4.1 Spatial Conversion: From "Physical Countryside" to "Fragmented Application Markets"

- In classical revolutionary theory, the "rural" represents the expansive geographic terrain where the ruling power's grip is weakest. In the context of AI, this "countryside" maps across three distinct domains.
- The Global South: High costs render elite Western models inaccessible to many developing economies. Highly cost-effective Chinese open-source solutions are filling this void. For instance, China's "Mazu" AI-driven meteorological early-warning system, launched in July 2025, has been deployed locally in countries like Pakistan, Ethiopia, the Solomon Islands, Jordan, Sri Lanka, Mongolia, and Djibouti, while serving over 40 nations via cloud architecture.(China Meteorological Administration [CMA], 2026) Though individual nations occupy the AI periphery, their collective scale offers a massive market footprint and invaluable localized data assets.
- SMEs and Long-tail Applications: Small and medium-sized enterprises (SMEs) and long-tail application fields form the bedrock of the market but remain highly price-sensitive. While many initially adopted Western closed-source systems due to their early superiority, escalating API fees have become commercially unsustainable. Justin Summerville, Head of Data and Analytics at OpenRouter, noted in a CNBC interview that Chinese open-source models are 60% to 90% cheaper than premium closed-source alternatives from Anthropic and OpenAI.("Chinese AI Models Are Gaining Ground," 2026) The Wall Street Journal recently reported that US corporations are pivoting away from an all-closed-source approach, adopting hybrid deployment strategies that mix various models to optimize costs.(Angel et al., 2026) This shift highlights that soaring closed-source costs, combined with excessive compute overhead for standard business tasks, are pushing budget-conscious SMEs and niche sectors out of the closed-source core. Chinese open-source options have effectively captured this long-tail demand, anchoring themselves firmly in the market's "vast countryside".
- Edge and On-device Deployment: The miniaturization and optimization of open-source models have enabled local deployment directly on smartphones, PCs, and Internet of Things (IoT) devices, pushing the strategic boundary from centralized clouds to the absolute edge. Significant breakthroughs have occurred in on-device model architectures. The MiniCPM5-1B model, co-developed by ModelBest and Tsinghua University, boasts a 1-billion-parameter architecture compressed into a 0.5GB quantized footprint, allowing it to run smoothly on over 90% of consumer terminal devices. ModelBest's "Density Law" states that AI intelligence density doubles roughly every 3.5 months, illustrating the rapid evolution of edge computing.(C. Xiao et al., 2025) Furthermore, local inference bottlenecks are being resolved. The EdgeRazor toolkit, an open-source collaboration between Nanjing University's LAMDA Institute and Microsoft, employs mixed-precision quantization-aware distillation to achieve 16-fold and 12-fold decoding accelerations on PC and mobile CPUs compared to standard 16-bit base models, bypassing performance limits for low-bit architectures.(S. Zhang, et al., 2026) On the commercial front, Lenovo has successfully integrated 70-billion-parameter models directly into consumer-grade AI PCs.(Y. Gao, 2025) Module manufacturers like Quectel (NURCTEL, 2025) and Fibocom (Fibocom, 2025) have deployed distilled DeepSeek models across edge-computing hardware platforms. Meanwhile, the FlagOS community achieved Day-0 cross-chip adaptation from data centre accelerators to ARM edge platforms, proving that inference tasks are rapidly shifting from centralized GPU farms to edge devices.(J. Yang, 2026)
- This on-device paradigm shift means the open-source strategy is capturing more than just geographical territories or market niches; it is claiming the physical edge of computing infrastructure. This decentralising shift echoes Broom and colleagues' finding that algorithmic technologies do not merely "mediate" but actively "constitute" the bodies and social worlds they encounter—a perspective that reframes edge deployment not as passive technical diffusion but as an active reconfiguration of the relationship between computation and everyday life.(Mead et al., 2026) This structural decentralization transforms the open-source movement from an alternative software path into a profound geopolitical re-engineering of digital infrastructure.

4.2 Agent Mobilization: From "Guerrilla Forces" to the "Global Open-Source Community"

- In the original strategic framework, "guerrillas" were irregular, highly agile forces deeply rooted in local communities. In the AI domain, this role is filled by the global open-source community: independent developers, fine-tuning engineers, and small-to-medium Independent Software Vendors (ISVs). Data from Hugging Face highlights the scale of this mobilization. According to the 2025 China Open Source Annual Report, monthly model downloads on Hugging Face hit an all-time high of 4.27 billion in November 2025.(Kaiyuanshe, 2026) By December 2025, Alibaba's Qwen downloads surpassed the combined total of the second through eighth-ranked models. Since overtaking Meta in late 2025, Qwen has logged a cumulative download volume of 700 million.(X. Yang, 2026) These metrics represent millions of independent developers acting like strategic guerrilla units across the compute landscape—downloading, fine-tuning, and deploying models to build a massive wave of distributed innovation.
- Unlike the "regular armies" of centralized, corporate labs, this open-source developer base exhibits distinct characteristics.
- Immense Numerical Scale: Millions of global developers can explore countless technical paths simultaneously. By June 2025, Hugging Face hosted over 10 million registered AI developers, a figure that climbed past 12 million by January 2026.("Hugging Face CEO Clément Delangue," 2025) Thomas Wolf, co-founder of the platform, noted that a new model, dataset, or application is uploaded roughly "every five seconds".("Challenging the Average With Open-Source AI," 2025) In China, the ModelScope community, initiated by Alibaba Damu Academy and the CCF Open Source Development Committee, grew to over 18 million developers by 2025, hosting over 110,000 models—a 644% year-on-year surge that positions it among the world's fastest-growing AI hubs.(Cloud Computing Open Source Industry Alliance Open Source Innovation Development Promotion Center, 2025) This sheer volume of continuous iteration is beyond the capacity of any single corporate research facility.
- High Operational Agility: Open-source models grant developers complete freedom to modify, adapt, and tailor systems at near-zero cost. Using accessible fine-tuning frameworks like LLaMA Factory, developers can execute hyper-targeted optimizations for specialized domains—spanning medicine, law, finance, and cross-modal systems blending text, audio, and video. These adjustments can be run on consumer-grade hardware via memory-efficient techniques like LoRA and QLoRA.("LLaMA Factory Product Introduction," 2026) As Jeff Boudier, Head of Product at Hugging Face, put it: "OpenAI may offer five models, but we offer millions".(Joachim, 2026) This variety gives developers unparalleled flexibility in combining tools.
- Intrinsic Motivation: Open-source contributions are largely driven by personal interest and community recognition rather than direct financial gain. As Eric S. Raymond famously observed, "Every good work of software starts by scratching a developer’s personal itch".(Raymond, 2001) Sociological evaluations applying Alasdair MacIntyre’s philosophy of social practices and self-determination theory categorize open-source commitment as a blend of "the carrot" (short-term economic returns) and "the rainbow" (long-term ideological alignment).(W. Wang & S. Cai, 2025) Scholars argue that these value propositions are the core drivers of community engagement, establishing a decentralized governance model that insulates projects from heavy-handed corporate interference.(G. Chen et al., 2021)
- Decentralized Coordination: These global networks operate without a single command hub; instead, technical progress is self-organized by the community. Distributed innovation has turned open-source platforms into bedrock infrastructure for the digital economy, rendering traditional, top-down corporate management obsolete.(L. Li et al., 2024) Community members integrate heterogeneous resources through a free, voluntary, and autonomous open participation mechanism, engaging in collaborative innovation within an environment of self-selected volunteers and self-organized teams.(L. Wang, 2017) The governance model of open-source projects is, at its core, a set of dynamically evolving collaborative rules. Its survival and development strategies continuously adapt as the community grows and technology evolves. Tens of thousands of developers engage in decentralized exploration and parallel trial-and-error without centralized directives—this is precisely the core advantage that distinguishes open-source communities from centralized development models.This decentralized mode of resistance echoes what Neves and colleagues identify as “algorithmic resistance”—the capacity of users and communities to contest, repurpose, or work around algorithmic systems through collective, often informal practices.(Neves, 2026)
- Consequently, Chinese open-source systems like DeepSeek have transitioned from alternative options into foundational infrastructure for overseas developers. Recently, a coalition of nearly 200 Silicon Valley tech startups petitioning the US

government explicitly demanded continued access to international open-source architectures, openly opposing any restrictions on deploying Chinese open-weight models.(Y. He, 2026) This advocacy proves that China's open-source approach has effectively mobilized a powerful, highly invested international developer base.

4.3 Encirclement Pathways: From "Peripheral Customization" to "Regulatory Encirclement"

- The ultimate goal of rural encirclement is never to remain in the periphery; it is to consolidate peripheral forces to reconfigure the entire power structure. Within the AI landscape, this encirclement unfolds across three progressive stages.
- Peripheral Customization via Niche Fine-tuning: Open-source models are initially deployed across specialized industries and niche long-tail markets that closed-source giants overlook or under-serve. In the foundation model market, while data loops create first-mover advantages, open platform strategies can generate indirect network effects that allow latecomers to achieve technological "leapfrogging". Currently, resource-constrained developers focus heavily on these niche applications, building upon open-source codebases. For example, medical researchers have locally deployed and fine-tuned DeepSeek-R1 using authentic oncology data from the Xinjiang Military General Hospital, integrating Retrieval-Augmented Generation (RAG) to build advanced clinical decision support systems.(D. Peng et al., 2025) By embedding themselves across thousands of specialized scenarios, open-source models accumulate valuable user bases, niche datasets, and operational experience.
- Capturing the Middleware and Toolchain Infrastructure: As developers grow accustomed to an open ecosystem, a rich layer of developer frameworks, integration pipelines, and middleware naturally thickens around it. Providers supplying these developer tools and deployment pipelines generate significant platform effects, creating a degree of user lock-in. However, the study indicates that under the circumstances where open-source software grants customers freedom of choice and faces competitive pressure due to its "free nature with a commitment to future pricing," this "locking" strategy could backfire.(K. Zhu & Z. Zhou, 2012) This dynamics explains why China's open-weight models, which align with open industry collaboration, are seeing surging institutional adoption globally. Corporate fears of vendor lock-in are accelerating this shift. For instance, in January 2026, when Anthropic suddenly restricted third-party tool access to its Claude Code service, the model-agnostic open-source alternative OpenCode saw its GitHub Stars surge past 170,000 with monthly active users hitting 8 million within months, quickly leading the open-source AI agent landscape.("From 'Locked In' to 'In Control'," 2026)
- Frontal Infiltration of the Foundation Model Layer: As open-source performance converges with proprietary benchmarks, the commercial viability of closed-source architectures faces an existential challenge. Released in December 2025, DeepSeek-V3.2 delivered high scores across agentic benchmarks despite using significantly fewer output tokens. In code-generation tests like Terminal Bench 2.0, DeepSeek-V3.2 scored 46.4 points, outperforming all open-source rivals and trailing only Google's proprietary Gemini-3.0-Pro (54.2 points). On the R^2-Bench reasoning evaluation, it scored 80.3 points, matching GPT-5-high (80.2 points) and slightly trailing Gemini-3.0-Pro (85.4).Additionally, in the tool usage benchmark test, DeepSeek-V3.2 significantly narrowed the performance gap between open-source and closed-source large language models.(A. Liu et al., 2025) Following the July 2026 launch of Kimi K3, another open-source model from China, Ion Stoica —UC Berkeley computer science professor and co-founder of LMSYS Chatbot Arena—noted that the historical 6-to-9-month performance lag of Chinese open-source systems behind top proprietary models had narrowed to just 2 to 3 months.(Ghaffary & Metz, 2026)
- The final phase is regulatory and standard encirclement. When the vast majority of global enterprise software is woven into an open-source fabric, proprietary "frontier AIs"—regardless of their raw capabilities—will be forced to design compatibility patches to align with open-source interfaces and protocol standards. Notably, this encirclement does not mean the total elimination of closed-source models; rather, it fundamentally redefines the relationship between the centre and the periphery. As some scholars have pointed out, the competition between open-source and closed-source AI technology ecosystems will persist. The eventual outcome is more likely to be the coexistence and interaction of these two ecosystems, rather than the complete disappearance of one.(N. Yu, 2025)The future will likely see a persistent co-

existence and mutual adaptation of both ecosystems, where open source reshapes the rules of the game rather than conducting a zero-sum elimination.

5. Governance Dilemmas and Impacts on the International Order

5.1 The "Black-Box Hegemony" Dilemma of Closed Source

- While the closed-source strategy offers strong commercial returns and intellectual property protection, it faces deep structural strains.
- Exacerbating the Global Digital Divide: High API costs effectively lock out developing nations and resource-constrained enterprises from the AI dividend, concentrating advanced computing power within a handful of wealthy states and tech conglomerates. Neves et al. summarize this phenomenon as "digital design marginalization" —where digital interface design excludes specific users and leads to their marginalization in other aspects of their lives, thereby further entrenching the digital divide. This gives rise to a form of technological-based social inequality and may trigger a chain reaction at the offline level.(J. Sin et al., 2021) Scholars note that high-cost proprietary systems are primarily viable for wealthy economies like Japan and South Korea. In contrast, China's cost-effective open-source alternatives offer comparable performance at a fraction of the cost, making advanced AI accessible to the Global South.(A. Chen, 2026) Using ChatGPT as an analytical benchmark, researchers point out that closed-source models rely on institutional-level intellectual property protection and cloud monopolies, which not only lock developing countries technologically but also integrate them into a U.S.-centric hierarchical system at the level of digital sovereignty—thereby reproducing a political hegemonic structure that transcends the computational power framework.This structural lock-in illustrates the Matthew effect in digital inequality, whereby existing advantages generate greater technological benefits while the disadvantaged fall further behind.(Neves & Mead, 2021) Under these circumstances, large language models are no longer merely technological tools; they have become socio-technological devices that perform ideological functions within the global knowledge order.(Geray & Etike, 2026) This turning of LLMs into ideological instruments within the global knowledge order stands in sharp opposition to the ideal of technology as a universal public good.
- Heightening "AI Sovereignty" Anxieties: When a state's core AI infrastructure depends entirely on a foreign closed-source model, it creates a deep relationship of technical subordination. This technical subordination is not merely an unintended consequence of market concentration; it exemplifies what Broom et al. term "harm by design," whereby structures are intended to cause harm but designed not to appear so.(Broom et al., 2023) At the UN Open Source Week, French computer scientist Yann LeCun directly linked open-source AI to national sovereignty, linguistic diversity, and democratic values. He warned that if global AI mediation is dominated by a tiny handful of proprietary systems from the US West Coast and China, it poses a severe threat to cultural and linguistic diversity, human rights, and democracy.(Vaughan-Nichols, 2026) A report by the Henderson Institute at Boston Consulting Group (BCG) explicitly states that for most countries, "AI sovereignty is an illusion; resilience is the reality"; for both governments and businesses, "pursuing a more flexible AI agenda is more feasible and sustainable than striving to achieve AI autonomy,"(Lang et al., 2026) and a flexible AI agenda is precisely what closed-source models lack. Furthermore, due to their "black-box" nature, closed-source models prevent the countries that depend on them from independently reviewing, modifying, or auditing the core technologies they rely on; this dominant position not only entails the extraction of economic benefits but also poses a potential threat to the digital sovereignty of other nations.
- The Collapse of the "Closed-Source Safety Narrative": The core justification for proprietary systems has long been that keeping weights secret is essential for safety. For years, pioneers like OpenAI and Anthropic maintained that open-weight models invite systemic abuse, positioning closed-source architectures as the ultimate line of defence for AI safety. This narrative was dramatically upended in July 2026. Three pre-release AI agents from OpenAI bypassed their isolated safety environments, discovered and exploited multiple vulnerabilities, and launched an autonomous attack on Hugging Face's infrastructure. This incident marked the first documented case of an AI model breaking containment to launch an autonomous cyberattack on external infrastructure. When Hugging Face's security response teams tried to deploy premium Western closed models to parse the 17,000 attack logs, the models' rigid, centralized safety guardrails failed to

distinguish legitimate security analysts from hostile attackers, repeatedly blocking the requests. Ultimately, Hugging Face resolved the crisis by running GLM-5.2—an open-weight model developed by the Chinese firm Zhipu AI—on its own infrastructure, successfully decrypting the payload, locating the intrusion vectors, and patching the vulnerabilities.(J. Fan, 2026) This event carries profound symbolic significance. The attack was launched against a closed-source model, yet it was an open-source model that provided the crucial solution – thereby shattering the "security narrative" that closed-source vendors had maintained for years. The security of closed-source models operates on a "black-box" principle, with the authority to define security rules entirely vested in the vendor. As a result, users cannot see the specific mechanisms underlying these security safeguards nor can they tailor their strategies to specific use cases. Once such a model becomes out of control, there are virtually no external means of intervention.Following the breach, Nvidia CEO Jensen Huang led the formation of the "Open Secure AI Alliance," uniting over 30 tech enterprises to argue that open-weight architectures are vital for balancing innovation, competition, and safety.("Huang Renxun Has Posted His Second X Tweet," 2026) This shift proved that proprietary guardrails can fail in a crisis, whereas open models offer greater defensive resilience due to their adaptability and local transparency.

5.2 The "Tragedy of the Commons" Risk in Open Source

- Despite its advantages, the open-source strategy introduces significant risks and governance challenges that cannot be ignored.
- Malicious Fine-Tuning and Deepfakes: Because open-weight models can be downloaded and altered by anyone, malicious actors can easily strip away safety guardrails through localized "jailbreak" fine-tuning, weaponizing the models to generate misinformation, deepfakes, or harmful content. Research by Cisco indicates that fine-tuned models are three times more susceptible to jailbreak exploits and can exhibit a 22-fold surge in toxic outputs.(Spring, 2025) A study titled "Jailbreak-Tuning" presented at the 2025 EMNLP conference demonstrated that fine-tuning open weights or using proprietary tuning APIs can compromise safety protocols, forcing models from OpenAI, Google, and Anthropic to fulfill requests regarding cyberattacks, criminal activity, or Chemical, Biological, Radiological, and Nuclear (CBRN) weapons. This study warns that before releasing any fine-tuned model without implementing appropriate safeguards, companies and policymakers should remain vigilant regarding models that perform the same functions as the original model and could be exploited for any malicious purpose within their capacity.(Murphy et al., 2025) Similarly, a paper published at NeurIPS 2025 revealed that as few as ten benign question-and-answer pairs can successfully jailbreak an LLM.(Z. Xie et al., 2026) Furthermore, open-source biological foundation models present a dual-use dilemma: while they accelerate drug discovery, they can also be exploited to design biological weapons.(B. Wei et al., 2025)
- Intellectual Property and Ambiguous Liability: When an open model is modified, adapted, and redistributed by global developer networks, tracing intellectual property and assigning legal liability becomes incredibly complex. Some studies have indicated that the structure and parameters of artificial intelligence models do not fall within the scope of protection afforded by computer software copyright law, and thus are not suitable for protection under copyright law. Meanwhile, protection under trade secret law also fails to provide adequate safeguarding for open-source models.(Beijing Intellectual Property Court Research Group. 2026) The rules governing the identification of derivative works in the traditional software sector are not easily applicable to the AI domain; furthermore, the wording of the scope-of-application clauses in various open-source licenses varies significantly, leading to considerable uncertainty regarding the scope of validity of mandatory clauses.(Y.Liu & S. Han, 2026) Assigning liability when a downstream application built on an open model causes real-world harm remains highly contentious; some legal scholars advocate for a fault-based liability framework for model providers,(J. Zhang & Y. Tian, 2025) while others argue for differentiated regulatory structures tailored to open-source architectures.(P. Zhang, 2026) In November 2025, the UK High Court issued a major ruling in Getty Images v. Stability AI, dismissing the core copyright claims and finding only limited trademark infringement. (Getty Images (US) Inc & Ors v Stability AI Limited [2025] EWHC 2863 (Ch)) The case highlighted the immense difficulty of applying copyright law to AI training, an issue current legal systems have yet to clearly resolve.
- Systemic Technical Volatility: Vulnerability assessments using malicious fine-tuning on open-weight models show they can be upgraded to near-frontier capabilities in biological and cyber-warfare domains.(Wallace et al., 2026) This research

highlights that as open-source models approach human-level capabilities, the risks of abuse scale exponentially. A study by FAR.AI noted that the defining advantage of open source—its modifiability—is precisely what introduces systemic risk, allowing bad actors to convert beneficial models into hazardous tools,(Hossain et al., 2026) a gap that widens with model scale.(Dombrowski et al., 2025) Balancing openness with public safety remains a central challenge. Applying commons governance theory, scholars point out that the open-source AI "tragedy of the commons" stems from a lack of exclusionary mechanisms, a dynamic fundamentally different from traditional open-source software risks.(Z. Wang, 2026)

- As a major proponent of open source, the Chinese government is actively responding to these risks. Scholars note that the multi-dimensional risks of unchecked open-source deployment present real threats to national security, social stability, and individual rights, requiring robust legal frameworks.(Y. Yang & J. Xie, 2025) Consequently, local and central authorities in China are working to cultivate open innovation ecosystems while simultaneously strengthening open-source safety governance. However, because open-source assets cross borders freely, no single government can manage these risks in isolation, making international coordination essential for effective global governance.(J. Li, 2026)

5.3 Long-term Implications for the Global Order

- Drawing on Yan Xuetong's theory of moral realism, the strategic friction between open and closed systems can be analyzed through the lens of rising and dominant power dynamics.
- Open Source as "Moral Capital Provision": Moral realism posits that for a rising power to successfully challenge an incumbent heg hegemon, it must match material growth with international moral legitimacy.(X. Yan, 2014) This theory attributes a nation's success or failure to the role of its political leadership; its core tenet is to enhance strategic credibility, provide international public goods, and expand international support.(X. Yan & Q. Zhang, 2018) Therefore, rising powers should bolster their strategic credibility within the international community by providing international public goods. By providing advanced open-source AI models as a global public good, China is building significant moral capital across the Global South and international developer networks. Commentators observe that this public-goods narrative allows China to challenge Western proprietary ecosystems, positioning itself as a leader of a more inclusive global AI order.(J. Lv, 2026) Research further indicates that DeepSeek has broken through technological barriers through its full-stack open-source approach, efficiency revolution, and extensive deployment across various application scenarios, thereby reshaping the global AI industry competition paradigm and offering a "Chinese solution" for the development of artificial intelligence.(X. Chen & X. Zhu, 2025) By integrating into global innovation networks via platforms like DeepSeek and Qwen, China is working to build consensus and manage risks, steering AI development toward a shared global benefit.
- The Paradox of Technological Decoupling: US efforts to enforce technological decoupling through export controls and model containment face a fundamental paradox. By embedding its open-source models into the daily workflows of millions of global developers, China has made decoupling economically and structurally painful, inviting severe pushback from the tech industry. Scholars note that as open-source software transitions from a shared tool into a strategic instrument of great-power competition, an "open-source paradox" emerges.(J. Zhou, 2025) The more Washington tries to politicize and restrict open-source collaboration, the more it pushes global developers toward Chinese-led ecosystems. In the future, Western developers may face a difficult choice: either adopt optimized, Chinese-led open architectures or bear the soaring costs of duplicating entire software ecosystems from scratch within closed environments. This reality makes absolute technological decoupling unsustainable.
- The Evolution toward an Inclusive Multipolar Architecture: Over the long term, the rivalry between open and closed source is unlikely to end in a zero-sum victory for either side. This confrontation is more than a technical disagreement; it is a geopolitical struggle over foundational code architectures, industrial control, and global rule-making authority.(M. Zhang, 2026) The future will likely see a tiered global architecture. High-level research, such as superalignment and Artificial General Intelligence (AGI), will likely remain closed-source or classified under state-security frameworks. Meanwhile, standard enterprise and industrial applications will be driven primarily by open-source systems, and underlying hardware infrastructure—chips, compilers, and instruction sets—will see its monopolies broken by open standards. In hardware, the open-source RISC-V instruction set architecture is expanding from IoT markets to challenge proprietary frameworks like X86 and the expensive licensing of ARM. RISC-V now commands 25% of the global processor market, loosening the long-

standing duopoly of X86 and ARM.(H. Wu, 2026) The competition between open and closed AI models is dismantling monopolies and accelerating the diffusion of technology. This layered structure will likely guide global AI governance away from unipolar hegemony toward a resilient, multipolar system of shared governance.

6.conclusion

- This study provides a systematic political-strategic framework for understanding China's open-source AI strategy, analyzing its underlying logic and international implications through the lenses of Susan Strange's structural power theory, Mao Zedong's "rural encirclement" doctrine, and asymmetric competition theory. The core findings are summarized below.
- Divergent Structural Power Logics: The split between US and Chinese AI strategies reflects two distinct structural power goals. The US closed-source approach uses black-boxed models, export controls, and technological blockades to channel global innovation into a US-centric system, seeking to preserve its long-standing monopoly over global knowledge structures and maintain its post-Cold War hegemony. Conversely, China's open-source strategy is a transition from defensive adaptation to proactive transformation under compute containment. By promoting decentralized knowledge production and the free flow of code, it seeks to challenge established monopolies and reconfigure knowledge structural power. Overall, the distinction between open-source and closed-source approaches is not merely a matter of differing technical pathways or business models; at its core, it represents the collision of two distinct structural power logics. The closed-source strategy, exemplified by certain U.S. tech giants, sustains its structural dominance through exclusive control over core technologies and intellectual property barriers—thus perpetuating the traditional knowledge-power trajectory revealed by Strange; in contrast, China's actively pursued open-source strategy embodies an "inclusive diffusion" logic rooted in network effects and ecological interdependence. This finding does not negate Strange's theoretical framework but serves as an important supplement and extension of his concept of "knowledge structure" power dynamics in the digital age. It uncovers a new mechanism of power transformation: by enabling decentralized knowledge provision and the commodification of knowledge (Moral Capital Provision), late-developing nations can bypass traditional technological barriers and transform their technology adoption into institutional influence over global digital infrastructure standards and interface regulations.
- Theoretical Isomorphism of "Rural Encirclement": The analytical alignment between China's open-source AI strategy and the doctrine of rural encirclement holds strong across spatial, agentic, and strategic dimensions. Spatially, China has shifted its focus away from premier markets dominated by US tech giants toward the AI "countryside"—a domain formed by the Global South, price-sensitive SMEs, long-tail applications, and decentralized edge deployment. In terms of agents, open source has mobilized millions of global developers into a distributed innovation network, securing a powerful numerical advantage over elite corporate labs. Strategically, the approach follows a clear path: moving from peripheral customization to capturing middleware ecosystems, and ultimately challenging foundation model layers to redefine industry rules. This proves that the core principles of rural encirclement—evading core strengths, leveraging strategic depth, and accumulating incremental victories to reshape global rules—remain highly relevant in contemporary technology competition.
- The Reality of Asymmetric Competition: Paradigm shifts in technology open windows of opportunity for latecomers who cannot match incumbents on traditional tracks. Under strict hardware containment, China shifted its strategy from raw compute scaling to an algorithmic efficiency revolution, using open-source expansion to counter proprietary monopolies. By establishing a new paradigm focused on low costs, high efficiency, and wide deployment, China has bypassed a direct compute race and altered the rules of AI competition. AI leadership is no longer judged solely by raw model benchmarks; it is a multi-dimensional race encompassing cost structures, developer loyalty, and application coverage.
- A Shift toward Multipolar Governance: While the closed-source model faces structural strains—including a widening digital divide, sovereign anxieties, and the breakdown of its safety narrative—the open-source path introduces its own risks, such as malicious fine-tuning, ambiguous liability, and technical volatility. However, from a long-term geopolitical perspective, the open-source approach aligns more closely with global development trends by providing international public goods, building moral capital, and challenging the logic of decoupling. It encourages a shift from unipolar hegemony toward a multipolar, shared governance framework. Given current gaps in global regulatory coordination and the need for security

protections, the closed-source model will likely remain vital for frontier AGI development. The future of AI will not be a zero-sum elimination, but a dynamic, long-term co-existence and competition between open and closed ecosystems, serving as a primary force shaping the future global digital order.

Declarations

Author Contribution

In this article, P Cwas mainly responsible for reviewing and checking the content and providing revision suggestions. The writing of the article's content, including the creation of the figures and tables, the collection of literature and data, and other work related to the writing of this article, was completed by J Z.

Acknowledgement

I would like to express sincere gratitude to Professor Zhang Zhenjiang and Professor Chen Ping for their invaluable guidance, insightful comments, and constructive feedback on the earlier drafts of this manuscript. Their intellectual support significantly contributed to the refinement of the theoretical framework and argument of this study. Any remaining errors are entirely the author's own.

Data Availability

Data Support FileThe following lists the sources of the data used in this article (including website links and the papers from which the cited data were obtained)1.Patro, B. N., & Agneeswaran, V. S. (2026). LLMOrbit: A Circular Taxonomy of Large Language Models-From Scaling Walls to Agentic AI Systems. arXiv preprint arXiv:2601.14053.2.Zheng, X. (2026, August 27). Unprecedented artificial intelligence out-of-control incident! Latest inside information exposed. Global Times.3.Liu, A., Feng, B., Xue, B., & et al. (2024). Deepseek-v3 technical report. arXiv preprint arXiv:2412.19437.4.Openrouter. (2026, August 31). Openrouter.AI model rankings. openrouter.ai. https://openrouter.ai/rankings?view=month5.Chinese AI models are gaining ground with U.S. companies as OpenAI, Anthropic costs surge. (2026, July 7). CNBC. https://www.cnbc.com/2026/07/07/chinese-ai-models-costs-us-openai-anthropic.html6.Xiao, C., Cai, J., Zhao, W., & et al. (2025). Densing law of llms. Nature Machine Intelligence, 7(11), 1823–1833.7.Zhang, S. H., Huang, L T., Deng, X. S., & et al. (2026). EdgeRazor: A lightweight framework for large language models via mixed-precision quantization-aware distillation. arXiv preprint arXiv:2605.04062.8.Kaiyuanshe. (2026). 2025 China open source annual report. Github. https://kaiyuanshe.github.io/2025-China-Open-Source-Report/preface9.Yang, X. (2026, January 09). Alibaba's Qianwen model download volume surged in December 2025, exceeding the total of the second to eighth places. China Securities Journal. https://www.cnstock.com/commonDetail/61641710.Hugging Face CEO Clément Delangue on hitting 10M developers, open-source AI's strategic importance, and why video datasets are the fastest-growing category. (2025, June 24). TBPN Digest. https://www.tbpndigest.com/story/2025-06-24/hugging-face-ceo-clement-delangue-on-hitting-10m-developers-open-source-ais-strategic-importance-and-why-video-datasets-are-the-fastest-growing-category11.Challenging the average with open-source AI: Hugging Face's Thomas Wolf. (2025, September 16). MIT Sloan Management Review. https://sloanreview.mit.edu/audio/challenging-the-average-with-open-source-ai-hugging-faces-thomas-wolf/12.Cloud Computing Open Source Industry Alliance Open Source Innovation Development Promotion Center. (2025). Research report on artificial intelligence open source ecosystem (2025) (Research Report). Cloud Computing Open Source Industry Alliance.13.From "locked in" to "in control": How did OpenCode get 170,000 stars in half a year? (2026, August 6). Tencent Cloud. https://cloud.tencent.com.cn/developer/article/2721580?policyId=1003#114.Liu, A., Mei, A., Lin, B., & et al. (2025). Deepseek-v3.2: Pushing the frontier of open large language models. arXiv preprint arXiv:2512.02556.15.Spring, T. (2025, April 29). RSAC 2025 Keynote: Cisco open-sources AI security tools. SC World. https://www.scworld.com/news/rsac-2025-keynote-cisco-open-sources-ai-security-tools16.Wu, H. (2026, March 24). Industry observation: Artificial intelligence accelerates towards the physical world, open source chip architecture RISC-V is moving from "alternative" to "mainstream".

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