

## Algorithmic Sovereignty and the Reconfiguration of International Power: The U.S.-China Rivalry as a Structural Model

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Algorithmic sovereignty is furthered through this study to demonstrate the structural change of power in the modern international system. It states that twenty-first century sovereignty is becoming more and more embedded within computational infrastructures, artificial intelligence systems, semiconductor supply chains, and transnational data architectures as opposed to territorial mastery or military power. Succeeding structural realism, the article analytically extends the concept of structural realism with the Algorithmic Structural Realism, which asserts that the dispensation of algorithmic capabilities has emerged as a key determinant of systemic hierarchy.

The study presents the U.S.-China technological rivalry as a systematic comparative case to study and analyze the competition in three interconnected business areas: advanced semiconductors, cloud computing and digital infrastructures, and telecommunications standards. It shows that these industries are strategic value chains whose management defines structural positions in the global digital order. Mechanisms of algorithmic deterrence are discussed as export controls, technological sanctions, and supply chain weaponization. The article creates three variable-based future scenarios of digital unipolarity, technological bipolarity, and distributed digital multipolarity that are founded upon the changes in semiconductor dominance, AI innovation dominance, standards regulation, and alliance formation trends.

It concludes that the polarity in the new order is shifting to a hybrid techno-structural form where the ability to interfere or even take over digital infrastructures becomes a fundamental mechanism of power balancing and systemic influence.

**Keywords:** Algorithmic Sovereignty, Structural Realism, Digital Geopolitics, Weaponized Interdependence, U.S.-China Technological Rivalry

## Introduction

The international system is experiencing a radical shift whereby power is becoming more and more concentrated in computational structures rather than in territorial possession or traditional military primacy. Artificial intelligence, sophisticated semiconductor manufacturing, hyperscale cloud infrastructure, and transnational information networks have taken center stage in economic productivity, military performance, and geopolitical power. In this regard, state power is measured not merely by industrial capacity or force projection, but by the capacity to produce, regulate, and scale algorithmic systems in interdependent digital ecosystems.

The history of sovereignty has been transforming together with the developments in the material basis of power. The Westphalian system stressed territorial integrity and legal autonomy; the industrial age-based sovereignty on productive power and control of resources; and the nuclear age reconsidered hierarchies through the use of deterrence and concentrated destructive power. The modern age is one where structural power is based on the capabilities of algorithms and data governance systems. The capability of executing state-of-the-art chips, creating frontier AI systems, managing cloud systems, and exerting technological control determines systemic positioning and strategic advantage in a manner that goes beyond conventional evaluation of military and economic power.

This international restructuring also rearranges the international order architecture. Computational infrastructures are general-purpose enablers that combine economic, military, and informational space, whereas dependency, vulnerability, and leverage are created by exerting control over them. The United States-China technology competition is an example of this change and includes rivalry in semiconductor supply chains, AI ecosystems, cloud computing, telecommunication standards, and cross-border data regulation. Their interlocking chains of value develop strategic levels of hierarchies where one layer can be controlled to gain control in another, not only through AI implementation, but also AI implementation in the armed forces.

Consequently, sovereignty in the algorithmic age is further determined by the ability to empower, deny, or destabilize digital infrastructures. Algorithmic capabilities should now be taken into account in the calculation of polarity and balance-of-power, in addition to traditional metrics. The new international order is therefore not determined by changing economic weight or military spending only, but by the allocation and regulation of technological ecosystems. In this respect, the capacity to control the world's digital infrastructures becomes the decisive determinant of systemic hierarchy and the core aspect of twenty-first-century state power.

### Research Importance

This paper posits algorithmic sovereignty as one of the fundamental determinants of power in the twenty-first century, no longer as a matter of territory and military strength, but as a matter of control over semiconductors, artificial intelligence infrastructure, cloud computing systems, and telecommunications standards.

As the U.S.-China technological rivalry reveals, strategic value chains and interdependent digital ecosystems have turned into determinants of systemic hierarchy, sources of deterrence, and leverage without traditional force. Future scenarios that are driven by variables are also developed in the research, providing insights into strategic planning, alliance management, and technological governance. It offers a timely framework of power, polarity, and influence in the new digitalized age.

**Research Objectives:** The study aims to achieve the following objectives:

1. Theorize the notion of algorithmic sovereignty as one of the main aspects of state power and systemic power in the twenty-first century.
2. Evaluate the U.S.-China technological confrontation as a structured example of how algorithmic capabilities—semiconductors, AI infrastructure, cloud computing, and telecommunications standards—are shaping the global pecking order and leverage.
3. Re-establish the balance of powers and mechanisms of deterrence in the algorithmic era by stressing the strategic meaning of control over digital infrastructures.

4. Create scenarios of variable development for the future global digital order to deliver analytical instruments for predicting systemic pathways, strategic risks, and policy opportunities.

### Research Problem

Digital infrastructure, the emergence of artificial intelligence, and groundbreaking semiconductors are changing the principle of state power and sovereignty. This raises critical questions about how algorithmic capabilities influence international hierarchy, strategic leverage, and the structure of the global order. The main research question is:

How does the concentration of algorithmic capabilities reshape sovereignty, power distribution, and systemic hierarchy, as illustrated by the U.S.-China technological rivalry? This question raises sub-questions:

1. How has sovereignty shifted from Westphalian territorial power to present algorithmic sovereignty, and how can structural realism account for the dispersion of algorithmic power?
2. How does algorithmic sovereignty and strategic advantage operate in the competition between the United States and China in AI, cloud computing, semiconductors, and telecommunications infrastructure?
3. How do algorithmic capabilities affect balance-of-power relations, deterrence, and future international order environments, e.g., digital unipolarity, technological bipolarity, and distributed multipolarity?

### Research Hypothesis

Algorithmic capabilities constitute a new source of structural power that redefines sovereignty, systemic hierarchy, and balance-of-power relations. States with access to state-of-the-art artificial intelligence systems, semiconductor manufacturing, cloud infrastructure, and telecommunications standards gain disproportionate strategic advantage, both in power and in deterrence across other domains, beyond traditional military and economic indicators. As a result, U.S.-China technological competition is an example indicating that concentration of

algorithmic capabilities creates interdependent digital hierarchies, rearranges the mechanisms of power projection, and changes the structure and polarity of the modern international system.

## Research Methodology

The main method of this research is analytical methodology in order to investigate the role of algorithmic potential in the formation of sovereignty and hierarchical order. The comparative approach examines the U.S.-China technological competition with an emphasis on the difference in approach and management. A historical approach traces sovereignty from Westphalian to algorithmic forms, which provides contextual grounding. Lastly, a futures-driven strategy speculates on potential paths of the global digital order, such as unipolar, bipolar, and distributed multipolar configurations. This combined approach guarantees explanatory breadth and strategic vision.

## Research Structure

The paper begins with an analytical conceptual and theoretical discussion of how sovereignty has shifted from its Westphalian origins to algorithmic sovereignty, which, within structural realism, encompasses algorithmic abilities as well. It then analyzes the U.S.-China technological rivalry in artificial intelligence, semiconductors, cloud infrastructure, and telecommunications as a rivalry about the distribution of capabilities. The paper then continues to account for the place of systemic elements of algorithmic sovereignty in shaping the balance of power in the digital age and deterrence. Lastly, it develops rational future conditions of digital unipolarity, technological bipolarity, and distributed multipolarity to examine possible paths of the emerging digital world order.

## I. The Conceptual and Structural Transformation of Sovereignty in the Algorithmic Age

Sovereignty in the modern international system is changing radically, shifting beyond territorial and industrial bases to computational and algorithmic bases. States are gaining power, not merely through boundaries and armies, but through command over

information, AI systems, semiconductor manufacturing, and cloud systems. This section looks at the historical development of sovereignty and places the concept of algorithmic power within a structural realist approach which emphasizes that technological competencies have become the fundamental determinants of systemic power.

## **I-I. From Westphalian Sovereignty to Algorithmic Sovereignty: The Transformation of the Sovereign Domain**

Sovereignty is not a fixed phenomenon, but changes with transformations in the material or technological basis of political power. It is not merely a set of laws, but an incarnation of the existing forms of power upon which the international system is based at any historical moment. Whether it be territorial control during the Westphalia era or algorithmic control during the digital era, sovereignty has shifted over time and has increasingly become less a geographically defined power and more a structurally determined power.

### **I-I-1. Westphalian Sovereignty: Territory, Authority and Independence**

The modern doctrine of sovereignty is conventionally traced to the Peace of Westphalia (1648), which institutionalized the principles of territorial integrity and juridical equality among states. While historical scholarship cautions against mythologizing 1648 as a clean break, the Westphalian model remains analytically useful in capturing the consolidation of territorial statehood and the norm of non-intervention (Krasner, 1999, p. 21; Osiander, 2001, p. 266).

Max Weber's classical formulation further anchored sovereignty in the state's monopoly on the legitimate use of physical force within a given territory (Weber, 1946, p. 78). Here sovereignty was inseparable from spatial enclosure: authority was territorially bounded, coercion centralized, and legitimacy juridically recognized.

Stephen Krasner's typology clarifies that sovereignty comprises multiple dimensions: international legal sovereignty, Westphalian sovereignty (non-intervention), domestic sovereignty (authority structures), and interdependence sovereignty (control over transborder flows) (Krasner, 1999, pp. 3-4). Crucially, even at

this early stage, sovereignty involved control over flows—of goods, people, and ideas—across borders. However, these flows remained materially embedded in territory.

In structural terms, sovereignty during this phase was primarily geospatial. Power derived from control over land, populations, and coercive instruments. The state's position in the international system was largely determined by territorial scale, demographic mass, and military capacity.

### **I-I-2. Industrial-Resource Sovereignty: The Materialization of Power**

The Industrial Revolution fundamentally altered the material basis of sovereignty. Control over strategic resources—coal, steel, and oil—and industrial production capacity became decisive determinants of state power. As Paul Kennedy demonstrates, the rise and fall of great powers has historically been tied to their relative economic and industrial productivity (Kennedy, 1987, pp. 149-152).

The economy became militarized through industrialization. The ability to mobilize industrial production toward war—what later came to be called the military-industrial complex—transformed the concept of sovereignty into the power of resource mobilization. The role of coercive extraction and industrial logistics in state formation was famously articulated by Charles Tilly, who stated that war made the state and the state made war (Tilly, 1990, p. 67).

In this stage, sovereignty grew beyond territory to encompass strategic supply chains and industrial infrastructure. National security became associated with resource security. Sovereignty thus expanded territorially into areas of colonial ownership, water routes, and global resource chains.

In structural realist terms, industrial capacity became a core component of the distribution of capabilities within the international system (Waltz, 1979, pp. 131-132). Polarity was increasingly defined not only by troop numbers but by productive capacity.

### **I-I-3. Nuclear-Deterrence Sovereignty: Strategic Destruction and the Balance of Terror**

The nuclear revolution introduced a qualitative transformation in sovereignty. As Bernard Brodie observed shortly after Hiroshima, the chief purpose of military establishments shifted "from winning wars to averting them" (Brodie, 1946, p. 76). Nuclear weapons created a condition in which survival depended on credible deterrence rather than territorial conquest.

Thomas Schelling's theory of deterrence further pointed out that power now resided in the ability to pose unacceptable harm. The concept of sovereignty became connected to second-strike capability and strategic stability. The logic of balance of power was substituted with the balance of terror.

Kenneth Waltz later argued that nuclear weapons induced systemic stability by making great power war prohibitively costly (Waltz, 1981, pp. 5-6). Sovereignty during the nuclear age thus rested on the ability to guarantee existential survival under conditions of mutual vulnerability.

The self-governing state was still territorially based, yet its defense depended on the level of technological advancements and command mechanisms. Power was no longer quantified only by the ability to control land and industry, but by the ability to maintain viable deterrence in an anarchic order.

#### **I-I-4. Digital Sovereignty: Governance of Cyberspace and Data Flows**

Another structural change was observed in the late twentieth and early twenty-first centuries, when cyberspace became a strategic domain. According to Manuel Castells, power operates within the network society, where information circulation is reshaping economic and political systems (Castells, 2010, pp. 21-24).

Digital sovereignty emerged as states attempted to control cyberspace, secure critical infrastructure, and regulate cross-border data flows. Laura DeNardis highlights Internet governance and technical standards as areas of geopolitical conflict (DeNardis, 2014, pp. 5-8).

Digital sovereignty includes: regulation of digital platforms, protection of critical infrastructure, cybersecurity doctrine, and data localization policies (DeNardis, 2014, pp. 47-49; Castells, 2012, pp.

123-126; European Commission, 2020, pp. 14-16). However, digital sovereignty is mainly regulatory: it deals with the domination of data infrastructures and cyber domains. It does not necessarily entail domination of the algorithmic construction of decision-making processes.

### **I-I-5. Algorithmic Sovereignty: Structural Embedding in Computational Systems**

The modern stage features a more profound change: sovereignty over the systems of algorithms that define economic production, military activities, and political discourse.

The capacity of the state to create, organize, and deploy strategic algorithmic and advanced digital infrastructures, and to coordinate data flows in a manner that allows it to affect economic, security, and political conduct both domestically and internationally, may be defined as algorithmic sovereignty (Fiott, 2021, pp. 3-5).

This is not a mere notion of cybersecurity or digital regulation. It deals with dominion over: artificial intelligence structures, high-performance computing, semiconductor manufacturing, machine learning models, and platform ecosystems.

Shoshana Zuboff demonstrates that the process of data mining and algorithmic processing of gathered data creates a new source of behavioral power (Zuboff, 2019, p. 10). In geopolitical terms, such capabilities enable states to shape the strategic environment through predictive analytics, automated targeting, financial modeling, and information manipulation.

In contrast to cyber sovereignty—which concerns state jurisdiction in cyberspace—or digital sovereignty—which concerns regulatory control of digital infrastructure—algorithmic sovereignty concerns the control of computational decision-making structures.

Structurally, the sovereign domain has transitioned from being geographically localized to being integrated into networked computational infrastructures. Power is now created through: domination of semiconductor supply chains, leadership in AI research communities, control over cloud computing architectures, and control over the establishment of new technologies.

This change does not make territory less essential; instead, it transforms it. Data centers, chip manufacturing factories, undersea cables, and quantum computer centers exist on physical territory. Sovereignty becomes hybrid: it is territorial, factually, but computationally mediated.

Thus, across five historical phases, migrating sovereignty has included: enclosure of territory, industrial mobilization, nuclear deterrence, digital governance, and algorithmic structuration.

The central structural thesis is that sovereignty ceases to be exclusively territorially based and is increasingly becoming embedded in computational systems that organize global interdependence. Those states that can master algorithmic infrastructures are gaining not only technological benefits but systemic position in the international order.

Borders and armies are not the only ways to exercise sovereignty in the algorithmic age; there are also code, chips, data, and scales of computation.

## **I-II. Redefining Power: The Distribution of Algorithmic Capabilities in Structural Realism**

Structural realism, as formulated by Kenneth Waltz, rests on a parsimonious and powerful claim: the structure of the international system—defined by anarchy and the distribution of capabilities across units—conditions state behavior (Waltz, 1979, pp. 5-6). The ordering principle remains anarchic; units are functionally similar, and variation arises from the relative distribution of material capabilities. Traditionally, these capabilities have been measured in military strength, industrial output, population, and economic resources.

However, structural realism does not predetermine the content of capabilities. Waltz himself emphasizes that capabilities include "the size of population, territory, resource endowment, economic capability, military strength, political stability and competence" (Waltz, 1979, p. 131). The composition of capabilities, therefore, is historically contingent. What matters structurally is not the specific resource, but how its distribution shapes systemic hierarchy and constraints.

The central argument advanced here is that algorithmic capabilities have become structural components of power distribution in the contemporary international system. Artificial intelligence systems, semiconductor fabrication capacity, advanced computing infrastructure, and control over large-scale data ecosystems now perform functions analogous to industrial capacity in the nineteenth century or nuclear capability in the twentieth. They structure opportunities, constrain adversaries, and define the boundaries of strategic autonomy.

### **I-II-1. Anarchy in the Algorithmic Age**

The international system remains anarchic in Waltzian terms: there is no central authority above states (Waltz, 1979, p. 88). Yet the operational environment of anarchy has been transformed. Digital infrastructures—undersea cables, satellite networks, cloud architectures, and semiconductor supply chains—constitute a new layer of systemic interdependence.

Algorithmic interdependence compounds structural competition. Contrary to what John Mearsheimer argues, great powers are trapped in a competition to secure themselves in an anarchic environment (Mearsheimer, 2001, pp. 29-31). What has changed is the domain in which competition unfolds. Control over advanced chips, AI training models, and quantum computing research now shapes the strategic calculus of survival and dominance.

In this regard, algorithmic infrastructures transform into systemic assets whose distribution rearranges relative capabilities. Export regulations on advanced semiconductors, limitations on AI model access, and technological sanctions are structural methods of power projection.

### **I-II-2. States as Primary Actors in a Platformized World**

Structural realism continues to hold that states remain the main actors despite the emergence of multinational technology corporations. Even in cases where firms seem dominant, they exist within national regulatory and strategic ecosystems. Waltz emphasizes that it is not firms but states that ensure survival in an anarchic order (Waltz, 1979, p. 96).

The integration of technology firms into national security strategies—what some scholars describe as "techno-nationalism"—demonstrates that algorithmic capacity is increasingly subsumed under state strategy (Segal, 2018, pp. 5-7). Civil-military fusion policies, industrial subsidies, export control regimes, and AI governance regimes suggest that algorithmic infrastructures are not merely commercial goods but are viewed as strategic assets.

Therefore, algorithmic sovereignty does not eclipse the state; it restructures the material foundation upon which states seek power.

### **I-II-3. Distribution of Algorithmic Capabilities as a Structural Variable**

In structural realism, polarity emerges from the distribution of capabilities across major powers (Waltz, 1979, pp. 161-163). Historically, this meant counting divisions, industrial output, and nuclear arsenals. Today, systemic position increasingly depends on: advanced semiconductor fabrication (e.g., sub-7nm nodes), high-performance computing capacity, AI research ecosystems and model training scale, and control over global digital standards and data architectures (Miller, 2022, pp. 137-138, 176-178, 238-240).

The asymmetrical distribution of these capabilities generates structural hierarchies. For instance, the concentration of cutting-edge semiconductor production in a limited number of jurisdictions produces systemic leverage analogous to the concentration of nuclear weapons during the early Cold War. Technological chokepoints—such as extreme ultraviolet (EUV) lithography systems—create structural dependencies that constrain strategic autonomy.

As Robert Gilpin argued, shifts in the distribution of capabilities underpin systemic transformation (Gilpin, 1981, pp. 9-10). If algorithmic capabilities now constitute a central dimension of state power, then their redistribution signals potential structural change.

### **I-II-4. Toward Algorithmic Structural Realism**

Building on Waltz's theoretical architecture, this study proposes an analytical extension: Algorithmic Structural Realism. This extension preserves the core premises of structural realism: the international system remains anarchic; states are primary security-

seeking actors; and the distribution of capabilities defines systemic structure. However, it updates the content of capabilities to reflect contemporary technological transformation. Its foundational claims are:

**I-II-4-1. Digital-algorithmic capabilities constitute systemic power resources.**

Control over AI systems, computational scale, and semiconductor production determines strategic autonomy and coercive leverage.

**I-II-4-2. Control over computational infrastructures reshapes polarity.**

If polarity reflects relative capabilities concentration, then dominance in algorithmic infrastructures may generate forms of technological unipolarity or bipolarity within a broader multipolar environment.

**I-II-4-3. Technological asymmetries produce structural constraints analogous to military imbalances in earlier eras.**

States dependent on external chip supply chains or cloud infrastructures face strategic vulnerabilities comparable to reliance on foreign energy supplies or nuclear umbrellas (Farrell & Newman, 2019, pp. 45-47, 49-52).

In this framework, algorithmic power functions not merely as an economic asset but as a structural determinant of systemic hierarchy. The capacity to design, train, deploy, and scale advanced algorithms becomes a core element of relative power—just as industrial output defined the nineteenth century and nuclear arsenals defined the Cold War (Waltz, 1979, pp. 97-101; Gilpin, 1981, pp. 67-69).

If algorithmic capabilities are unevenly distributed, systemic consequences follow: technological chokepoints become instruments of coercion; supply chain weaponization becomes structurally feasible; standard-setting authority translates into geopolitical influence; and strategic autonomy becomes technologically mediated (Farrell & Newman, 2019, pp. 50-52, 54-55; Miller, 2022, pp. 182-184).

In sum, the structure of the international system is increasingly shaped by the distribution of computational power.

Sovereignty is no longer exclusively territorial; it is structurally embedded in algorithmic architectures. Structural realism, when analytically updated, provides a powerful framework for understanding this transformation. The logic of anarchy persists—but the material basis of power has shifted from territory and industry to code, chips, and computation.

## II. The U.S.-China Rivalry as a Contest over Algorithmic Capabilities Distribution

The U.S.-China rivalry represents the defining axis of contemporary competition over algorithmic capabilities, shaping the distribution of technological power in the twenty-first century. Control over artificial intelligence, computational infrastructure, and data governance now functions as a central structural variable, determining strategic autonomy and influence within the international system. This section examines how differences in innovation capacity, platform ecosystems, and civil-military integration translate into asymmetrical positions within the emerging algorithmic order.

### II-I. Strategic Superiority in Artificial Intelligence and Digital Infrastructure

The key arena of the algorithmic power struggle is the U.S.-China technological rivalry. Given that systemic hierarchy in structural realism indicates the allocation of capabilities, artificial intelligence has become a core structural variable. This subsection constructs a comparative analysis at three interrelated levels: innovation capacity, computational infrastructure, and civil-military technological integration (Waltz, 1979, pp. 131-132, 97-101; Lee, 2018, pp. 2, 94; Allison et al., 2021, p. 5).

#### II-I-1. Innovation Capacity

Innovation is the upstream generator of algorithmic power. AI leadership depends on sustained R&D investment, advanced research institutions, patent intensity, talent concentration, and platform-scale firms capable of training frontier models (Stanford University, 2023, pp. 38, 57).

##### II-I-1-1. Research & Development Expenditure

The United States and China are the world's two largest R&D spenders. According to OECD data, the United States remains the

largest single national R&D investor in absolute terms, while China has rapidly closed the gap over the past decade (OECD, 2023, p. 7). China's R&D expenditure has grown at a faster rate, reflecting long-term state planning embedded in initiatives such as "Made in China 2025" and the 2017 New Generation AI Development Plan (State Council of China, 2017, pp. 1-3).

Structurally, long-term R&D guarantees cumulative benefits. According to Gilpin, technological leadership change can precede systemic change (Gilpin, 1981, pp. 9-10). The U.S. remains strong in basic AI research and frontier model development, especially in terms of dominance through the private sector and venture capital system. China, on the other hand, is strategic in its approach with state coordination and long-horizon planning.

### **II-I-1-2. Artificial Intelligence Patent Output and Research Ecosystems**

Patent data illustrate the scaling dimension of China's AI strategy. The World Intellectual Property Organization reports that China leads globally in AI-related patent filings, reflecting state-supported expansion of domestic innovation (WIPO, 2019, p. 24). However, quantity does not always translate into frontier quality.

According to the Stanford AI Index, the development of frontier large language models and high-compute systems, such as GPT-series architectures and other foundational models, is controlled by U.S.-based institutions. The U.S. has unequal representation in the highest-tier AI research centers and the most prestigious AI conferences (Stanford University, 2023, pp. 55-57).

The structural implication is evident: China excels in scale, deployment, and patent intensity, while the United States excels in breakthrough innovation and frontier model architecture. This asymmetry generates differentiated strengths within the algorithmic hierarchy.

### **II-I-1-3. Leading Firms and Platform Power**

Corporate ecosystems are national capability multipliers. Companies like OpenAI, Google, DeepMind, Microsoft, NVIDIA, and Amazon are at the forefront of model training and cloud-scale development in the United States. Their global dominance in the digital arena strengthens U.S. techno-hegemonic capital (Farrell &

Newman, 2019, pp. 45, 49; Stanford University, 2023, pp. 15, 17, 41).

China's leading firms—Baidu, Tencent, Alibaba, Huawei—operate within a state-coordinated strategic framework. Elsa Kania notes that China's AI strategy explicitly integrates corporate innovation into national security planning under the civil-military fusion doctrine (Kania, 2017, pp. 3, 5; Allen, 2019, pp. 6, 10). Table (1) illustrates the structural distinction.

Table (1): Comparative Structural Characteristics of Leading AI Corporate Ecosystems – United States vs. China

Dimension	United States	China
Innovative Model	Market-driven, venture-capital intensive	State-coordinated industrial policy
Frontier Model Development	Dominant in large-scale foundational models	Rapid scaling and domestic deployment
Platform Global Reach	Global ecosystem leadership	Strong domestic ecosystem, expanding Global South presence

Source: Table prepared by the author based on the following sources:

Farrell & Newman, *Weaponized Interdependence*, 45-47.

Elsa B. Kania, "Artificial Intelligence and Chinese Military Power," CNAS Report (Washington, DC: Center for a New American Security, 2017), 3-6.

Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Boston: Houghton Mifflin Harcourt, 2018), 100–102.

Shane, Scott, "Open AI, Google, Microsoft: AI Leadership and Cloud-Scale Development," *TechCrunch*, 2022.

this table (1) clears that the U.S. model produces technological depth, the Chinese model produces mobilization scale.

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## II-I-2. Computational Infrastructure

Algorithmic power requires computational scale. AI systems are capital-intensive, compute-intensive, and semiconductor-dependent.

## II-I-2-1. Semiconductor Foundations

Developed AI systems rely on state-of-the-art semiconductor nodes. Chris Miller demonstrates that the semiconductor supply chain is one of the most strategically focused industries of the world economy. The export restrictions on semiconductor equipment and advanced chips imposed by the U.S. in 2022 highlight that semiconductor hegemony is leveraged as a weaponized structure (Miller, 2022, pp. 154, 168, 173, 182, 238).

Chokepoints in advanced fabrication are produced by extreme ultraviolet (EUV) lithography systems, which are controlled by the Dutch firm ASML (with U.S. technology input). China's access to sub-7nm manufacturing is limited, restricting its ability to train the most compute-intensive AI systems at scale. This creates structural asymmetry, as shown in Table (2).

Table 2: Structural Comparison of Semiconductor Capabilities – United States and China

Semiconductor Dimension	United States (and allies)	China
Advanced Chip Design	NVIDA, AMD leadership	Growing but dependent
EUV Access	Indirect control via alliance network	Restricted
Fabrication Nodes	Allied ecosystem (TSMC, Samsung)	Limited advanced-node capacity

Source: Table prepared by the author based on the following sources:

Miller, *Chip War*, 176-178, 182-184, 238-240.

Farrell & Newman, *Weaponized Interdependence*, 49-52, 53-55.

Technological chokepoints generate systemic leverage analogous to the nuclear monopoly during the early Cold War years.

## II-I-2-2. Cloud Computing and Data Centers

Cloud infrastructure is the working component of AI implementation. Industry analysis shows that Amazon Web Services (AWS), Microsoft Azure, and Google Cloud dominate global markets. Alibaba Cloud is the leader in China and in parts of Asia (Synergy Research Group, 2023, pp. 1-2; OECD, 2022, p. 34).

Control over hyperscale cloud infrastructure determines: training scalability, data aggregation capacity, and global digital dependency patterns.

Laura DeNardis argues that infrastructure governance translates into geopolitical influence. States whose firms dominate cloud architecture shape technical standards and data governance norms (DeNardis, 2014, pp. 6, 33).

### **II-I-2-3. High-Performance Computing (HPC)**

Supercomputing is becoming instrumental in the training of AI models. As of the TOP500 November 2023 list, 202 of the 500 fastest supercomputers in the world are based in the United States, with 173 in China. The two nations have alternated in leadership historically, but recent U.S. performance metrics are at the highest level (TOP500, 2023).

High-performance computing capacity correlates with: advanced weapons modeling, climate simulation, cryptography research, and frontier AI training. Thus, computational infrastructure directly influences strategic autonomy.

### **II-I-3. Civil-Military Technological Integration**

Algorithmic capabilities achieve structural relevance only when translated into military and security applications.

#### **II-I-3-1. Military AI Applications**

Both states incorporate AI into defense modernization. The U.S. Department of Defense's Joint Artificial Intelligence Center (JAIC) and subsequent AI integration efforts reflect institutional adaptation. China's People's Liberation Army (PLA) has incorporated AI into intelligence warfare doctrine (Kania, 2017, pp. 7-8).

The AI-military nexus includes: decision-support systems, predictive logistics, and ISR (intelligence, surveillance, reconnaissance) automation.

#### **II-I-3-2. Autonomous Systems**

Semi-autonomous weaponry and robotic systems are the operationalized versions of algorithmic power. As some researchers of developing military technologies claim, autonomy decreases reaction time and augments decision time, changing the nature of deterrence (Horowitz, 2018, pp. 17-19).

Both the U.S. and China are investing heavily in: drone swarms, maritime autonomous systems, and AI-enabled targeting. Control over advanced chips and AI training environments becomes critical for battlefield superiority.

### II-I-3-3. Surveillance and Security Architectures

China has implemented AI-powered surveillance at an unprecedented scale inside the country, combining facial recognition, predictive policing, and data aggregation. This has been referred to as digital authoritarian governance by some scholars. The United States implements AI in a different institutional and legal context, based on military integration rather than domestic surveillance.

One form of centralized mobilization in China is civil-military fusion. The American system is based on public-private alliances and networks of defense contracts. The rivalry reveals two distinct models of algorithmic power, as shown in Table 3.

Table 3: Comparative Structural Models of AI Surveillance and Security Architectures – United States vs. China

Structural Variable	U.S. Market-Driven Techno-Hegemony	China's State-Led Techno-Strategic Mobilization
Innovation Driver	Venture capital & private firms	State industrial planning
AI Frontier Models	Global leadership	Rapid domestic scaling
Semiconductor Leverage	Export control dominance	Strategic vulnerability
Cloud Infrastructure	Global dominance	Regional consolidation
Civil-Military Integration	Public-private hybrid	Centralized fusion doctrine

Source: Table prepared by the author based on the following source:

Lee, *AI Superpowers*, 8-12, 78-83, 90-94, 98-100, 100-102, 105-108.

Structurally, the United States retain leverage at technological chokepoint and frontier innovation layers. China compensates through scale, industrial policy and strategic coordination.

From a systemic perspective, this competition is not episodic; it reflects a redistribution of algorithmic capabilities that may determine the polarity of the twenty-first century international order.

Structurally, the United States retains leverage at technological chokepoint and frontier innovation layers. China compensates through scale, industrial policy, and strategic coordination.

From a systemic perspective, this competition is not episodic; it reflects a redistribution of algorithmic capabilities that may determine the polarity of the twenty-first-century international order.

## II-II. Data Control and Strategic Technology Supply Chains

The geopolitical fight over domination of strategic technology value chains is increasingly structured as dominance of semiconductors, cloud computing infrastructures, and telecommunications architectures. These are not commercial sectors; they are being deployed as systemic chokepoints that determine a state's structural location in the global digital hierarchy. In addition to the logic of weaponized interdependence, network hubs become a way of transforming economic interconnection into a source of coercive leverage (Farrell & Newman, 2019, pp. 44-45).

Rather than treating these sectors as discrete industries, this subsection conceptualizes them as strategic value chains whose governance shapes the distribution of algorithmic capabilities and, by extension, structural power.

### II-II-1. Semiconductors: The Core of Algorithmic Power

#### II-II-1-1. Advanced Chip Production and Structural Centrality

The basic hardware layer of artificial intelligence, high-performance computing, and military autonomous systems is composed of advanced semiconductors. Chris Miller demonstrates that control over semiconductor supply chains has become "a matter of geopolitical primacy rather than commercial competition" (Miller, 2022, pp. 1-3). The concentration of fabrication capacity in a small number of firms—particularly TSMC in Taiwan—creates systemic vulnerability and strategic leverage. As of 2023:

- TSMC produces over 90% of the world's most advanced logic chips (below 7nm nodes) (Miller, 2022, pp. 141-143).
- The United States dominates electronic design automation (EDA) software (Miller, 2022, pp. 156-158, 241-242).
- The Netherlands (ASML) controls extreme ultraviolet (EUV) lithography equipment, a critical chokepoint (Miller, 2022, pp. 183-185).

This fragmentation illustrates a structurally interdependent but asymmetrically controlled production architecture.

### II-II-1-2. Export Controls and Technological Containment

In October 2022 and October 2023, the U.S. Department of Commerce imposed export controls limiting China's access to advanced chips and semiconductor manufacturing equipment. Farrell and Newman define such actions as network-based coercion in the form of hub control (Farrell & Newman, 2019, pp. 61-65; U.S. Department of Commerce, 2022; U.S. Department of Commerce, 2023).

The policy base is supported by the CHIPS and Science Act (2022), which provides \$52.7 billion for domestic semiconductor manufacturing and R&D plus additional tax incentives (U.S. Congress, 2022, Sec. 9902). This represents not merely industrial policy but structural repositioning within global value chains.

### II-II-1-3. Taiwan's Structural Role

Taiwan is strategically positioned in the world's semiconductor chain. Its location makes the Taiwan Strait a systemic weakness for both Washington and Beijing. Miller contends that the concentration of semiconductors in Taiwan "redefines the geopolitical stakes of cross-strait stability" (Miller, 2022, p. 242).

Thus, semiconductor competition is not reducible to trade rivalry; it reflects a struggle over control of computational capacity at the foundation of algorithmic sovereignty, as shown in Table 4.

Table 4: Global Semiconductor Structural Distribution – Taiwan and Key Actors (2023)

Structural Role	Leading Actor(s)	Domain
Global share of advanced chips 90% ~	TSMC (Taiwan)	Advanced Logic Fabrication (< 7nm)
Dominant global suppliers	United States	EDA Software
Exclusive supplier	Netherlands (ASML)	EUV Lithography
Global AI accelerator dominance	U.S. (NVIDIA, AMD)	AI Chip Design

Source: Table prepared by the author based on the following sources:

Miller, *Chip War*, 137-138, 154-156, 182-184, 176-178.

U.S. Congress, *CHIPS and Science Act of 2022*, Public Law No. 117-167, sec. 1-3.

## II-II-2. Cloud Computing and Digital Network Infrastructure

### II-II-2-1. Infrastructure Dominance

Cloud computing platforms form the working underpinning of AI training, information storage, and worldwide digital services. Control over hyperscale cloud computing creates dependency patterns akin to maritime chokepoints in previous periods. Global market share (Statista; Synergy Research Group): Amazon Web Services (AWS): approximately 32%; Microsoft Azure: about 23%; Google Cloud: about 4%; Alibaba Cloud (top in China): about 10% (Synergy Research Group, 2023; Statista, 2023).

U.S.-based companies have a collective market share of more than 65% of the global cloud market, placing them at the center of transnational information flows (Synergy Research Group, 2023; Statista, 2023). This concentration reflects what DeNardis terms "infrastructure-based governance," where technical control translates into geopolitical influence (DeNardis, 2014, pp. 5-8).

### II-II-2-2. Transnational Data Governance and Strategic Dependency

The sphere of digital jurisdiction is becoming increasingly characterized by data localization laws, cross-border transfer

restrictions, and cybersecurity regulations. The Data Security Law (2021) in China effectively implements sovereign data control within national territory, whereas the U.S. applies extraterritorial legal tools like the CLOUD Act (2018). The resulting architecture creates what can be theorized as rival data governance regimes that strengthen digital blocs.

Farrell and Newman's model suggests that actors controlling central network nodes can weaponize interdependence (Farrell & Newman, 2019, pp. 44-47, 48-49). In cloud infrastructure, this logic applies directly: states dependent on foreign hyperscale providers face structural exposure, as shown in Table 5.

Table 5: Global Cloud Market Share – United States vs. China (2023)

Country	Estimated Global Share	Provider
United States	~32%	AWS
United States	~10%	Google Cloud
China	~4%	Alibaba Cloud

Source: Table prepared by the author based on the following sources:

**Synergy Research Group, “Cloud Market Share Report 2023”** (Reno, NV: Synergy Research Group, 2023).

**Statista, “Cloud Market Share 2023,”**

<https://www.statista.com/statistics/cloud-market-share-2023>

## II-II-3. Telecommunications Infrastructure (5G/6G)

### II-II-3-1. Huawei and Global Standard Competition

The connectivity layer of the digital order is characterized by telecommunications infrastructure. Before U.S. sanctions, Huawei became the largest telecom equipment vendor in the world based on revenue (Lee, 2018, pp. 80-81).

Infrastructure domination of 5G goes beyond hardware deployment to include dominance in standard-setting organizations such as 3GPP and ITU. Standard-setting power is a structural process of defining technological ecosystems (DeNardis, 2014, pp. 33-36). The U.S.-led restrictions on Huawei reflect concerns that infrastructure dominance could generate systemic surveillance and strategic leverage.

## II-II-3-2. Technological Alliances and Bloc Formation

The U.S. has encouraged other vendor ecosystems (Nokia, Ericsson) and reinforced alliances using structures like the Quad and the U.S.-EU Trade and Technology Council. Meanwhile, China has integrated telecommunications into its Digital Silk Road program. This division indicates new technological bloc formation, in which infrastructure decisions entrench long-term geopolitical orientation.

In semiconductors, cloud computing, and telecommunications, the competition is not only technological but structural. All domains constitute levels of a vertically integrated digital structure: Hardware Layer (Semiconductors), Infrastructure Layer (Cloud/HPC), Connectivity Layer (Telecom Standards). Control over these layers determines: AI training capacity, technological supremacy in the military, data governance authority, and standard-setting influence.

As in past eras where navies dictated trade hierarchies, algorithmic power is now embedded in computational supply chains. In previous systemic organizations, technological asymmetries became sources of structural constraints, similar to nuclear or industrial imbalances (Gilpin, 1981, pp. 9-10; Waltz, 1979, p. 131).

The U.S.-China competition in data control and technology supply chains indicates a structural conflict over: chokepoint domination, value chain domination, standard-setting capability, and computational domination. Semiconductors determine material capacity, cloud infrastructure determines operational capacity, and telecommunications standards determine systemic architecture. These, combined, form the strategic basis of algorithmic sovereignty and define each state's role in the new digital polarity system.

## III. Systemic Implications: Algorithmic Sovereignty and the Future of International Order

Strategic competition and power exercising in the international system are fundamentally changed by the emergence of algorithmic sovereignty. In the algorithmic age, military, economic, and digital spaces are gradually becoming more interconnected, and technological infrastructures are at the center of

deterrence and systemic stability. In this section, control over computational architectures, semiconductor chokepoints, and AI ecosystems are considered as factors that affect the balance of power, polarity, and the subsequent arrangement of the world digital order.

### **III-I. The Transformation of Power Balancing and Deterrence in the Algorithmic Era**

The shift to an algorithmic form of structural sovereignty brings with it far-reaching consequences for balance-of-power theory and the puzzle of deterrence. Although the international system remains anarchic by Waltzian definition, there is a qualitative change in the material basis of capability distribution (Waltz, 1979, pp. 88-90). Military force remains central, yet its effectiveness increasingly depends on algorithmic infrastructures, computational superiority, and network control.

The main argument of this subsection is that deterrence in the algorithmic era is increasingly based on the potential to disrupt, disable, manipulate, or structurally weaken computational infrastructures, rather than only causing kinetic devastation.

#### **III-I-1. The Convergence of Military and Algorithmic Power**

##### **III-I-1-1. AI-Enabled Warfare**

Artificial intelligence has been integrated into military planning, targeting systems, intelligence processing, logistics optimization, and predictive battlefield modeling. Historically, military power diffusion, as presented by Horowitz, hinges on the ability of organizations to incorporate complex technologies (Horowitz, 2018, pp. 18-20). AI represents such a general-purpose military technology.

The U.S. Department of Defense's 2018 AI Strategy explicitly identifies AI as critical to maintaining "decision superiority" (U.S. Department of Defense, 2018, pp. 8-10). Similarly, China's 2017 New Generation Artificial Intelligence Development Plan integrates AI advancement with military modernization objectives (State Council of China, 2017, sec. 2.3-2.4). This convergence suggests that algorithmic capability is no longer auxiliary to military power; it is constitutive of it.

### III-I-1-2. Autonomous Weapons Systems

Autonomous and semi-autonomous weapons systems reduce human latency in battlefield decision cycles. The danger lies not only in their lethality but in their speed. According to Freedman in his analysis of deterrence, the acceleration of technology changes the credibility and timing of coercive signaling (Freedman, 2003, pp. 36-38).

Unmanned drone swarms, AI-driven missile defense solutions, and algorithmic targeting systems shorten the OODA loop (Observe-Orient-Decide-Act) and create strategic instability without institutional control.

### III-I-1-3. Cyber Warfare Capabilities

Cyber operations are an area where disruption is more effective than destruction. Rid argues that cyber operations are unlike traditional warfare in that they may intend to sabotage, spy, or subvert, rather than destroy on the battlefield. However, their systemic effect may be severe when aimed at financial systems, energy grids, or military command infrastructures (Rid, 2013, pp. 1-5). Therefore, cyber capabilities are structural coercion tools that are integrated into the digital ecosystem.

### III-I-2. Algorithmic Deterrence

#### III-I-2-1. Network Disruption Deterrence

In classical deterrence theory, the credibility of punishment underwrites stability (Schelling, 1966, pp. 36-38). In the algorithmic era, punishment increasingly involves the threat of network paralysis. Dominating semiconductor supply chains, cloud architectures, or telecommunications standards allows states to introduce systemic disruption without kinetic amplification. This is conceptualized by Farrell and Newman as weaponized interdependence, in which network hubs create coercive leverage (Farrell & Newman, 2019, pp. 45-47).

An example of deterrence by denial is the October 2022 U.S. semiconductor export controls against China. Washington dictated Beijing's technological trajectory by limiting access to high-tech AI chips and fabrication equipment.

### III-I-2-2. Technological Sanction Regimes

Sanctions are now moving toward technological ecosystems as opposed to conventional commodities. The CHIPS and Science Act (2022) institutionalized industrial policy as strategic deterrence, increasing domestic fabrication capacity while restricting technological transfer (U.S. Congress, 2022, Sec. 9902; Sec. 103). This reflects a shift from deterrence by punishment to deterrence by infrastructure denial.

### III-I-2-3. Supply Chain Weaponization

Global supply chains, once optimized for efficiency, now operate as strategic vulnerabilities. As Miller demonstrates, semiconductor chokepoints provide opportunities for coercive leverage (Miller, 2022, pp. 176-178). Supply chain weaponization transforms economic interdependence into a deterrent instrument. Thus, algorithmic deterrence operates across: hardware chokepoints, software ecosystems, data governance regimes, and cloud dependency structures.

### III-I-3. Rethinking Polarity: Toward Hybrid Military-Digital Structures

#### III-I-3-1. From Military Polarity to Techno-Structural Polarity

In structural realism, polarity is determined by the distribution of material capabilities (Waltz, 1979, p. 131). In the past, it was military-industrial power. The capabilities of the algorithmic age are distributed across: AI research ecosystems, semiconductor fabrication capacity, cloud infrastructure leadership, and standard-setting authority. These dimensions constitute techno-structural power.

Gilpin's theory of systemic change suggests that shifts in productive and technological capabilities precede transformations in systemic hierarchy (Gilpin, 1981, pp. 9-10). The U.S.-China rivalry reflects precisely such a transition.

#### III-I-3-2. Hybrid Military-Digital Polarity

The modern world order is not necessarily bipolar in military aspects or multipolar in economic ones; we have a hybrid form. The U.S. remains the world's military powerhouse. China has scale advantages in data volume and state-coordinated mobilization. Technology ecosystems are becoming polarized. This setup

presupposes a new hybrid military-digital polarity, where structural power is produced by intersecting kinetic and algorithmic infrastructures.

### III-I-3-3. Strategic Stability Under Algorithmic Conditions

Algorithmic acceleration complicates strategic stability. AI-driven decision-support systems risk automation bias, escalation compression, and opaque signaling. Freedman notes that deterrence stability depends on clarity of signaling and rational calculation (Freedman, 2003, pp. 30-33). Algorithmic opacity may undermine both. Hence, the locus of deterrence shifts from destructive capacity to systemic vulnerability management.

Four systemic implications of the algorithmic balancing and deterrence transformation are: military power is becoming indistinguishable from algorithmic capability; deterrence works through infrastructural denial and network disruption; supply chains can serve as strategic levers; and polarity is assuming a techno-structural formation.

This novel form of order may create coercive leverage comparable to—and potentially even above—kinetic force due to the ability to disrupt digital infrastructure. Sovereignty is therefore embedded not just in territorial control but in computational calculus. The algorithmic age does not abolish realism; it modifies the material substrate through which realism operates.

### III-II. Strategic Scenarios for the Future of the Global Digital Order

The fact that sovereignty is being transformed into an algorithmically embedded structural capacity creates a key systemic problem: how will the allocation of algorithmic capabilities restructure the polarity and institutional architecture of the international system?

Consistent with structural realism, systemic outcomes are determined not by intentions but by the distribution of capabilities across units (Waltz, 1979, pp. 79-83). If algorithmic capabilities—semiconductors, AI innovation ecosystems, computational infrastructure, and standards-setting authority—constitute emergent structural resources, then variation in their distribution will shape future digital polarity.

This subsection creates three strategic scenarios based on four major structural driving variables: semiconductor dominance (fabrication, design, equipment control); AI innovation leadership (R&D ecosystems, frontier models, compute access); monopoly of international technology standards; and events of bloc consolidation and alliance alignment.

These scenarios are not projected predictions but analytically formulated projections based on changes in capability concentration and control over networks.

### III-II-1. Scenario I: Digital Unipolarity

Digital unipolarity would emerge from consolidating U.S. dominance in: advanced semiconductor fabrication (through reshoring and allied coordination), frontier AI model design, cloud infrastructure scaling, and international standard-setting institutions.

In structural realist terms, unipolarity persists when one state maintains overwhelming capability concentration across systemic dimensions (Waltz, 1979, pp. 131-132). If U.S.-led alliances successfully restrict China's access to advanced lithography and AI accelerators, technological asymmetry may widen (Miller, 2022, pp. 177-179). The use of export controls and industrial subsidies (CHIPS Act) would also be tools of structural preponderance.

Strategic Implications: Emboldening of U.S.-oriented digital standards; further superiority of U.S.-based hyperscalers; technological sanctions as an everyday tool of governance; minimization of systemic fragmentation. Deterrence in this setup is mainly achieved through infrastructural denial capacity located in U.S.-controlled chokepoints (Farrell & Newman, 2019, pp. 49-52, 53-55).

Early Warning Indicators: Sustained U.S. control over sub-3nm fabrication nodes; continued superiority of U.S. companies as global leaders in AI models; minimal Chinese innovation in EUV or next-generation lithography; convergence toward a single transatlantic digital regulatory regime.

### III-II-2. Scenario II: Technological Bipolarity

Technological bipolarity is a condition where two states (or blocs) have achieved relative parity in vital algorithmic capabilities but deny each other access to core ecosystems.

Historically, bipolar systems exhibit high structural clarity and alliance consolidation (Waltz, 1979, pp. 168-170). A digital bipolar order would require: Chinese self-sufficiency in advanced semiconductor production; parallel AI innovation ecosystems; competing telecommunications and standards regimes; and institutionalized technological decoupling. China's state-coordinated industrial mobilization, described by Lee as data-driven and scale-intensive (Lee, 2018, pp. 100-102), provides the foundation for such structural parity.

Strategic Consequences: Bifurcated cloud ecosystems; parallel supply chains; disjointed internet governance regimes; greater technological nationalism. Weaponized interdependence transitions into managed decoupling, reducing mutual vulnerability but increasing bloc rigidity (Farrell & Newman, 2019, pp. 47-49).

Early Warning Indicators: Chinese breakthrough in advanced domestic lithography tools; expansion of Digital Silk Road standards adoption; parallel 6G standard-setting coalitions; systematic cross-bloc export prohibitions.

Under bipolarity, deterrence stability may increase structurally but intensity competitively, as each bloc internalizes full-spectrum digital ecosystems.

### III-II-3. Scenario III: Distributed Digital Multipolarity

Distributed digital multipolarity would arise if additional actors—such as the European Union, India, Japan, or emerging technological coalitions—accumulated independent algorithmic capabilities sufficient to dilute bipolar concentration.

Gilpin emphasizes that systemic transformation follows shifts in productive capacity distribution (Gilpin, 1981, pp. 9-10). If semiconductor fabrication spreads geographically and AI innovation ecosystems become distributed, the pluralization of digital authority may result from the spread of capabilities. The EU's regulatory power—the "Brussels Effect"—shows how regulation

can operate as structural power without hardware control (DeNardis, 2014, pp. 33-36).

Strategic Consequences: Overlapping regulatory spheres; standardized but politically diversified structures; non-binary competitive supply chain structures; minimization of complete decoupling threats. Multipolarity brings complexity as well as the possibility of less systemic rigidity. Nevertheless, multipolar systems tend to generate more uncertainty, according to realism (Waltz, 1979, pp. 167-169).

Early Warning Indicators: Expansion of advanced fabrication capacity in Europe and India; emergence of independent AI foundation models outside the U.S.-China axis; multilateral digital governance institutions gaining authority; decline in bloc-exclusive technology regimes. Table 6 provides a comparative study of these scenarios.

Table 6: Structural Configurations of Algorithmic Power – Digital Unipolarity, Technological Bipolarity, and Distributed Multipolarity

Variable	Digital Unipolarity	Technological Bipolarity	Distributed Multipolarity
Semiconductor Control	U.S.-centered dominance	U.S.-China Parity	Geographically dispersed
AI Innovation	U.S. frontier lead	Parallel frontier ecosystems	Multiple innovation hubs
Standards Governance	Unified U.S. aligned regime	Competing standard blocs	Layered regulatory pluralism
Alliance Structure	Hierarchical	Bloc-based	Fluid and issue-specific
Deterrence Model	Infrastructure denial dominance	Mutual ecosystem exclusion	Network interdependence management

Source: Table prepared by the author based on the following sources:  
 Miller, *Chip War*, 137-138, 154-156, 176-178, 182-184, 238-240.  
 Farrell & Newman, *Weaponized Interdependence*, 44-47, 49-52, 54-55.  
 Lee, *AI Superpowers*, 100–102.

### III-II-4. Evaluation of the Revised Structure

This scenario framework supports the conceptual and theoretical integrity of the study in four aspects: (1) The notion of algorithmic sovereignty is formalized in terms of calculable structural variables (chip production, AI leadership, standard-setting power, and alliance consolidation). (2) The analysis is grounded in structural realism (systemic consequences of capability distribution rather than normative ambitions) (Waltz, 1979, pp. 79-83). (3) The U.S.-China rivalry functions as a structured comparative case within a broader systemic analysis, avoiding reductionism. (4) Future projections are variable-driven rather than speculative. Each scenario is anchored in observable structural shifts.

The global digital order will not be characterized solely by military force, but by: control over semiconductor chokepoints, AI innovation ecosystems, data governance regimes, standard-setting institutions, and alliance network consolidation. Twenty-first-century polarity can thus be comprehended not in dualistic terms of military versus economic, but as techno-structural polarity—a hybrid type of arrangement in which the distribution of algorithmic capabilities creates the system's hierarchy.

### Conclusion

As has been proposed in this paper, we are witnessing a structural change in sovereignty in the twenty-first century in terms of the redistribution of algorithmic capabilities. Although the international system remains anarchic and states continue to be the primary actors, the material foundation of power is no longer exclusively territory and industrial production, but rather computational facilities, semiconductor supply chains, artificial intelligence ecosystems, and digital standard-setting power. Sovereignty is not about spatial containment or kinetic capacity anymore; it is becoming embedded in networked computational structures that increasingly define economic activity, military potential, and political power.

Through the conceptualization of the phenomenon of algorithmic sovereignty and the development of an extension of structural realism—termed Algorithmic Structural Realism—the

research demonstrates that algorithmic capabilities today are systemic variables that cause changes in hierarchy, polarity, and strategic leverage. The U.S.-China technological rivalry shows that competition over semiconductors, cloud infrastructures, AI innovation, and telecommunications standards is not a series of isolated trade conflicts but a structural rivalry over the architecture of global power.

The discussion also indicates that non-kinetic disruption is increasingly becoming the basis of deterrence in the algorithmic era, through infrastructural disruption, technological denial, and supply chain leverage. As algorithmic interdependence grows in complexity, structural disequilibrium in computational capacity creates new vulnerabilities and coercive possibilities.

In conclusion, the new international order can be thought of topographically in a manner where polarity is defined by the dispersion of algorithmic capabilities. The battle over chips, code, data, and standards is not at the outer edge of global politics—it is its transforming core. Here, command of computational infrastructures is not merely an augmentation of state capability; it is a determinant of systemic location in the architecture of modern international power.

### Key Findings

1. Algorithmic capabilities are a structural facet of power. The analysis concludes that artificial intelligence systems, advanced semiconductor manufacturing, cloud systems, and standards management have become systemic resources. Their distribution significantly impacts global hierarchy and strategic independence.
2. Sovereignty has shifted from territorial enclosure to computational embeddedness. Sovereignty in the algorithmic age is more a matter of dominance over data flows, computational scale, and technological chokepoints than territorial or military dominance alone.
3. U.S.-China competition is structural competition, not a technological flare-up. The semiconductor, AI ecosystem, and digital infrastructure arms race is a conflict over the form

of global power and systemic location in the new digital order.

4. Technological chokepoints create coercive leverage. Dominance over high-value nodes—high-end lithography, machine learning accelerators, and hyperscale clouds—enables infrastructural denial measures used as instruments of deterrence.
5. Deterrence is becoming more infrastructural than kinetic. Algorithmic deterrence reshapes balance-of-power dynamics through supply chain weaponization, export controls, network disruption, and ecosystem blacklisting.
6. Polarity is shifting toward a techno-structural configuration. The international system is characterized by hybrid military-digital polarity, in which algorithmic capacity distribution is gradually becoming more decisive for systemic influence, complementing traditional military power.
7. Concentration patterns of capabilities determine future digital order outcomes. Semiconductor dominance, AI innovation leadership, standards control, and alliance alignment structures will define whether the future is characterized by digital unipolarity, technological bipolarity, or distributed multipolarity.

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