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Semiconductors as a Strategic Resource of Power in the Twenty-First Century

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Abstract:

Semiconductors underpin today's digital economy, global industry and modern military systems. Their strategic value stems not merely from the chips themselves, but from the concentrated capabilities required to design and manufacture them. The pandemic exposed the vulnerability of these supply chains, while US–China technological rivalry transformed semiconductors into a national security issue. This paper examines their shift from industrial inputs into instruments of power, identifies critical nodes along the supply chain, compares the responses of the United States, China and the European Union, and assesses the limits of reindustrialisation. Strategic influence depends on retaining decisive positions, securing alternative supplies and withstanding prolonged disruption.

Keywords:

Semiconductors, technological power, economic security, strategic autonomy, geopolitics

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Introduction

International power requires a material foundation. This has held true across vastly different eras. Wheat sustained populations and armies; coal fuelled industrialisation; oil enabled twentieth-century mobility. None of these was strategic purely by virtue of its physical properties, but because losing access curtailed production, heightened insecurity, and narrowed states' room for manoeuvre.

Semiconductors occupy a comparable position today, albeit driven by a distinct logic. They are not extracted from a deposit, nor do they rely on a single raw material. Their manufacture brings together advanced design, intellectual property, high-purity materials, precision machinery, and immensely capital-intensive facilities. It also demands highly specialised personnel who are both scarce in the labour market and in high demand. While a finished chip spans only a few millimetres, it relies on an infrastructure spanning several continents.

Chips feature in mobile phones, motor vehicles, power grids, medical equipment, data centres, and industrial processes. They power everyday consumer electronics such as televisions, washing machines, air conditioners, and refrigerators. Crucially, they also underpin military capabilities: without them, much of modern telecommunications, radar networks, guidance systems, drones, and electronic warfare platforms simply could not function. The so-called 'digital world' remains firmly anchored in physical realities: manufacturing plants, water, energy, cabling, and hardware components.

For decades, the industry advanced through increasing specialisation. Each stage was established wherever it found superior expertise, access to technology, lower costs, or adequate economies of scale. Distributing the supply chain across the globe accelerated innovation and reduced production costs. The trade-off, however, was a heightened vulnerability to disruptions that were difficult to absorb or offset. The pandemic laid this bare. Shortages of low-unit-value components brought car assembly lines to a halt and disrupted numerous other sectors. Cost is no longer the sole consideration: it matters equally who can supply a chip, from where, and under what political conditions.

The geopolitical rivalry between the United States and China accelerated this shift. Spurred by Chinese technological advances, Washington restricted the

sale of advanced processors and specialised manufacturing equipment to China. Beijing responded by expanding its technology-substitution programmes and seeking workarounds to US restrictions. Meanwhile, the European Union sought to recover part of its lost manufacturing capacity through industrial policy, investment, and regulation. Consequently, semiconductors moved out of the purely commercial realm to take centre stage in national security debates.

José Ignacio Torreblanca interprets this trend as technology returning to its role as a structural variable of international power: competition is no longer fought merely over commercial market share; technological rivalry now shapes alliances, technical standards, supply chains, and states' political autonomy[1]. Federico Aznar offers a complementary framework in which modern confrontation blends military, economic, technological, and informational means, coordinating them in pursuit of political objectives[2]. The struggle over semiconductors forms an integral part of this dynamic.

Semiconductors thus shape both innovation and industrial output. They directly impact national defence and a state's ability to act independently without excessive reliance on external actors. This article traces the process through which microchips have evolved into a strategic resource, identifies key centres of power along the supply chain, and evaluates whether current reindustrialisation efforts are genuinely mitigating structural vulnerabilities.

From Natural Resources to Technological Power

A resource acquires strategic value when its absence compromises vital functions and it cannot be replaced in a timely or effective manner. Physical scarcity is only part of the equation: the degree of reliance, the availability of substitutes, and who controls access are equally decisive. Water, for instance, may be abundant in one region yet critically scarce in another. Oil operates similarly: whilst traded on global markets, the geopolitical landscape shifts drastically if alternative suppliers are lacking or transit routes pass through unstable regions.

[1] Torreblanca, José Ignacio. «Poder, geopolítica, soberanía y tecnología», IEEE Analysis Paper 40/2026, 19 May 2026. Accessed: 12 August 2026. Available at: https://www.defensa.gob.es/ceseden/-/ieee-2026-poder-geopolitica-soberania-tecnologia-analisis40

[2] Aznar Fernández-Montesinos, Federico. «Los aranceles universales. Una nueva fase en la confrontación geopolítica entre China y Estados Unidos», IEEE Analysis Paper 55/2025, 10 September 2025. Accessed: 12 August 2026. Available at: https://www.defensa.gob.es/ceseden/-/ieee/los_aranceles_universales_2025_dieeea55

Semiconductors meet all these criteria. An ever-increasing range of human activity depends on them, whilst specific market segments rest in the hands of a select few companies. Switching suppliers is rarely straightforward; it often demands redesigns, rigorous testing, and months of adaptation. Furthermore, a regulatory decision or licensing restriction can severely hinder or block market access entirely. Yet, manufacturing alone is insufficient. Producers must achieve competitive levels of reliability and yield, maintain sustained capital investment, and innovate rapidly to avoid obsolescence.

However, possessing a broad consumer electronics industry does not equate to mastering technologies that alter the balance of power. A country can manufacture domestic appliance or automotive components while remaining dependent on imported processors for artificial intelligence, supercomputing, or defence systems. Strategic autonomy is therefore a matter of degree. It hinges on the specific chip, its strategic function, and where along the value chain supply is concentrated.

A semiconductor rarely generates a discrete political or military outcome in isolation, yet it can prove decisive. Artificial intelligence serves as a prime example: it requires raw computing power and, by extension, cutting-edge processors. Producing these chips demands design software, specialised machinery, raw materials, and expert talent that are controlled or supplied by a small handful of global actors. This chain of dependencies explains its strategic value far better than inspecting the final physical component alone.

The war in Ukraine demonstrates this dynamic in real time. Commercial drones, sensors, communications equipment, optronics, and precision-guided munitions frequently incorporate components originally designed for the civilian market. The line between civil and military use has blurred. Nevertheless, as Zacarías Hernández observes, possessing technology does not automatically confer power: it must be integrated into a doctrine, an organisation, and an industrial base capable of producing and adapting it over time[3]. A prototype merely demonstrates a possibility; sustained strategic capability demands mass production, iterative learning, and

[3] Hernández Calvo, Zacarías. «Ya lo dijo Napoleón, para ganar la guerra hacen falta tres cosas: innovación, innovación e innovación», IEEE Opinion Paper 45/2026, 24 April 2026. Accessed: 12 August 2026. Available at: https://www.defensa.gob.es/ceseden/-/ieee-2026-innovacion-guerra-rusia-ucrania-opinion45

continuous refinement.

The battle over chips extends far beyond transistor dimensions. It encompasses Electronic Design Automation (EDA) software, intellectual property, and advanced lithography or deposition machinery. It also includes ultra-pure chemicals, silicon wafers, packaging, testing, and specialised talent. The supply chain's complexity has distributed leverage across an extensive international network, even if certain critical nodes remain heavily concentrated.

A Global Chain with Critical Chokepoints

The term 'supply chain' is useful, yet it implies an overly linear sequence. The semiconductor industry functions more like a complex web of mutual dependencies and cross-border cooperation. Design, manufacturing, equipment, and materials are deeply interdependent. No single country controls the entire ecosystem.

The United States leads in design, intellectual property, EDA software, and specific manufacturing equipment. Taiwan holds a commanding share of advanced semiconductor foundry capacity. South Korea occupies a pivotal position in memory chips and fabrication. Japan retains hard-to-replace capabilities in specialised materials, silicon wafers, and precision machinery. Europe contributes critical lithography equipment, power electronics, and industrial microchips. China has a vast domestic market, a broad manufacturing base, and growing weight in mature nodes, assembly, packaging, and testing. The global geography of the sector thus combines complementary specialisations that rely on one another.

This international division of labour lowered production costs and unlocked economies of scale. However, it also created bottlenecks. Some technologies embody decades of cumulative research and rely on thousands of niche suppliers. Coordinating them demands extreme precision. Consequently, a comparable competitor cannot be created overnight or through a single influx of capital.

ASML represents the clearest example. The Dutch firm is the world’s sole supplier of Extreme Ultraviolet (EUV) lithography systems, which are essential for producing leading-edge chips. Its monopoly does not rest on a single patent, but on decades of sustained capital investment and an intricate global supplier network. In 2025, ASML reported sales of €32.7 billion and invested nearly €4.7 billion in research and

development[4]. These figures illustrate the sheer effort required to maintain such a technological lead.

Taiwan represents another critical node. The island holds a dominant position in contract manufacturing and accounts for an exceptionally high share of global advanced logic chip production. TSMC, the world's largest contract chipmaker, pioneered the dedicated foundry model, manufacturing designs developed by fabless companies. This model enabled the growth of giants like Apple, Nvidia, AMD, and Qualcomm, but it also concentrated a vital portion of global manufacturing capacity on an island situated in one of the most geopolitically sensitive regions in the world.

This concentration gave rise to the concept of the 'silicon shield'—the idea that global reliance on Taiwan raises the cost of military conflict so high as to act as a deterrent. While this argument underlines TSMC's geopolitical significance, it does not preclude conflict. Economic interdependence raises the price of war, but it does not eliminate national, political, or military drivers. Nor does it guarantee that all actors evaluate risk and cost through the same lens.

Recent Chinese advances in lithography warrant cautious analysis. In late 2025, Reuters reported on a Chinese EUV lithography prototype capable of generating extreme ultraviolet light, though it remains far from reliably producing advanced chips at industrial scale[5]. In July 2026, the same agency reported the start of production for domestically developed Chinese immersion Deep Ultraviolet (DUV) lithography tools[6]. While this represents a notable milestone, these tools must still prove their performance, reliability, and integration within commercial production lines. ASML retains a substantial lead in both performance and scale. Nevertheless, the strategic lesson is clear: technological monopolies can erode over time, and no position

[4] ASML. Annual Report 2025. Net sales of EUR 32.7 billion and R&D expenditure of EUR 4.7 billion. Accessed: 12 August 2026. Available at: https://www.asml.com/en/investors/annual-report/2025

[5] Reuters. «How China built its 'Manhattan Project' to rival the West in AI chips», 17 December 2025. The report describes a Chinese EUV prototype capable of generating extreme ultraviolet light, but still far from reliable industrial production. Accessed: 12 August 2026. Available at: https://www.reuters.com/world/china/how-china-built-its-manhattan-project-rival-west-ai-chips-2025-12-17/

[6] Reuters. «China starts production of home-grown immersion DUV chipmaking tools», 28 July 2026. The report notes the start of production of immersion DUV equipment developed in China and cautions that its performance and reliability at industrial scale still have to be proven. Accessed: 12 August 2026. Available at: https://www.reuters.com/world/china/china-starts-production-home-grown-immersion-duv-chipmaking-tools-source-2026-07-28/

should be presumed permanent.

While specialisation underpins the efficiency of the global supply chain, it also creates vulnerabilities. Private corporations, allies, and strategic rivals control distinct segments of the network; no single authority governs the whole. An actor commanding a critical, hard-to-replace node can restrict or condition access for others. At that juncture, interdependence ceases to be merely a source of economic efficiency and transforms into a leverage point for geopolitical pressure.

The US–China Rivalry

The strategic competition between Washington and Beijing has dispelled the earlier appearance of commercial neutrality surrounding the semiconductor industry. Cost remains relevant, but it is no longer the decisive metric. Governments now scrutinise who designs the chip, where it is fabricated, and under whose legal jurisdiction the vendor operates. They also evaluate their strategic room for manoeuvre should supply lines be cut.

The United States retains important advantages in microprocessors, software, and capital equipment. However, over several decades, it offshored a significant share of manufacturing to East Asia. Washington's concerns extend beyond civil supply chain vulnerabilities: it seeks to restrict China's access to advanced chips used in artificial intelligence, supercomputing, surveillance, and military modernisation.

The American strategy combines industrial policy with targeted technology export controls. Subsidies, tax credits, and R&D funding aim to reshore manufacturing capacity within US borders. Simultaneously, export controls impede Beijing's access to high-performance processors and advanced manufacturing equipment. This 'small yard, high fence' policy focuses protection on a narrow band of critical capabilities. It does not aim for complete economic decoupling, which is practically unfeasible given existing interdependencies.

The primary challenge lies in defining the boundaries of that 'yard'. Expanding its scope increases costs for Western firms, complicates diplomatic coordination with allies, and incentivises China to accelerate domestic alternatives. While restrictions may hamper a rival in the short term, they also signal that foreign suppliers are unreliable, spurring import-substitution efforts.

Beijing has responded with state financing, support for domestic firms, talent recruitment, and targeted national programmes to reduce foreign dependencies. Although China still trails in specialised advanced equipment, it leverages a vast domestic market, a broad industrial infrastructure, and experience in improving products at scale. While these assets do not immediately offset its technology gaps, they enable China to sustain long-term research efforts while building out domestic capabilities.

Consequently, the semiconductor value chain is entering a period of structural realignment. The United States leverages its leadership in design and equipment, a broad network of allies, and the sheer scale of its economy. China relies on its market size, industrial capacity, and state-led resource allocation. Should current trends persist, increasingly distinct technological ecosystems will emerge. A total decoupling remains unlikely due to the sheer density of existing commercial ties, the severance of which would impose high costs on both sides.

US export controls on China essentially buy time. This window will prove effective only if converted into domestic research, manufacturing capacity, workforce training, and allied cooperation. Otherwise, the technological gap is likely to narrow. For China, external pressure has transformed the pursuit of technological self-reliance into a national priority.

US Reindustrialisation: Progress and Constraints

The CHIPS and Science Act, passed in 2022, was driven in large part by strategic concerns. The legislation earmarked $52.7 billion to revitalise the domestic semiconductor industry, including roughly $39 billion in direct manufacturing incentives and $11 billion for advanced R&D[7]. Washington aims to rebuild onshore manufacturing capacity in a sector deemed crucial to its economic and national security.

Under this framework, the US Department of Commerce awarded up to $6.6 billion

[7] National Institute of Standards and Technology (NIST), CHIPS for America. The CHIPS Act allocated USD 52.7 billion to the sector; USD 39 billion is for incentives and USD 11 billion for R&D. The Department of Commerce awarded up to USD 6.6 billion to TSMC Arizona and up to USD 4.745 billion to Samsung Electronics. Accessed: 12 August 2026. Available at: https://www.nist.gov/chips/chips-incentives-funding-opportunities; TSMC Arizona: https://www.nist.gov/chips/tsmc-arizona-phoenix; Samsung: https://www.nist.gov/news-events/news/2024/12/biden-harris-administration-announces-chips-incentives-award-samsung

in direct funding to TSMC Arizona and up to $4.745 billion to Samsung to expand its industrial footprint in Texas[8]. However, bridging the gap between awarding financial incentives, constructing a semiconductor fabrication plant ('fab'), and achieving stable, high-yield mass production is a lengthy and technically demanding process.

Progress is nevertheless underway. TSMC Arizona's first fab initiated volume production using N4 process technology in late 2024. A second facility is scheduled to begin N3 production in the second half of 2027, while construction on a third fab continues[9]. US industrial policy is actively reshaping the global manufacturing landscape, though its full strategic impact will emerge only gradually.

Building physical fabs does not automatically eliminate strategic dependencies. Each plant demands ultra-pure water, a reliable energy supply, reliable chemical suppliers, logistics infrastructure, specialised engineers, and sustained commercial demand. Much of Asia's competitive edge derives from decades of accumulated operational know-how and dense industrial clusters, rather than low labour costs alone. Replicating that ecosystem will take years.

While new domestic facilities will mitigate specific supply risks, the United States will remain dependent on European capital equipment, Japanese specialised materials, and an international network of sub-suppliers. Even the Arizona fab remains an extension of a company whose core operational base and primary R&D remain firmly anchored in Taiwan. Reshoring reshapes risk profiles, but it does not remove the inherently international nature of the semiconductor industry.

Success should not be judged by whether the entire supply chain returns to US soil. What matters more is establishing sufficient domestic capacity to serve critical national sectors, diversify supply risks, and absorb external shocks during a crisis. This metric leaves several open questions: Can public subsidies be sustained over the long term? Will these facilities remain commercially viable across changing

[8] National Institute of Standards and Technology (NIST), CHIPS for America. The CHIPS Act allocated USD 52.7 billion to the sector; USD 39 billion is for incentives and USD 11 billion for R&D. The Department of Commerce awarded up to USD 6.6 billion to TSMC Arizona and up to USD 4.745 billion to Samsung Electronics. Accessed: 12 August 2026. Available at: https://www.nist.gov/chips/chips-incentives-funding-opportunities; TSMC Arizona: https://www.nist.gov/chips/tsmc-arizona-phoenix; Samsung: https://www.nist.gov/news-events/news/2024/12/biden-harris-administration-announces-chips-incentives-award-samsung

[9] TSMC. TSMC Arizona: N4 volume production began in the fourth quarter of 2024; N3 production at the second fab is planned for the second half of 2027; the third fab is under construction. Accessed: 12 August 2026. Available at: https://www.tsmc.com/static/abouttsmcaz/index.htm

market cycles? Might these large-scale investments eventually induce global overcapacity?

Europe and the Boundaries of Strategic Autonomy

The European Union enters this competitive arena from a position of relative disadvantage. Nevertheless, it commands key assets, including ASML, market-leading chipmakers like Infineon, STMicroelectronics, and NXP, and leading research institutes like IMEC. Europe's strengths reside primarily in lithography, power electronics, automotive components, and industrial automation. Despite these advantages, its global manufacturing share remains low, leaving essential technologies dependent on non-EU suppliers.

The European Chips Act, which entered into force in 2023, sought to bolster R&D, attract advanced semiconductor foundries, and improve supply chain resilience against future crises. The initiative aimed to mobilise over €43 billion in public and private investment, setting a target to secure 20% of global semiconductor output by 2030. As of 2026, the EU accounts for roughly 9% of global production[10]. In June 2026, the European Commission proposed a 'Chips Act 2.0' aimed at reinforcing industrial capabilities, curbing strategic dependencies, and supporting both legacy and leading-edge technologies[11].

This shortfall cannot be attributed solely to administrative slowness in Europe. The United States, China, Taiwan, South Korea, and Japan are simultaneously ramping up their own state support. To double its global market share, Europe would need to grow faster than a global market in which all of its main competitors are also increasing investment. That market is expanding rapidly under the impulse of artificial intelligence and demand for high-performance computing. The 2030 target therefore depends both on Europe’s own efforts and on the pace set by its competitors.

[10] European Commission. 2026 State of the Digital Decade: the EU accounts for around 9% of the global semiconductor market, compared with the 20% target for 2030. Accessed: 12 August 2026. Available at: https://digital-strategy.ec.europa.eu/en/policies/2026-state-digital-decade-package

[11] European Commission. «Proposal for the Chips Act 2.0», 3 June 2026. The proposal seeks to strengthen the European semiconductor industry, reduce strategic dependencies and support the production of advanced and conventional chips. Accessed: 12 August 2026. Available at: https://digital-strategy.ec.europa.eu/en/library/proposal-chips-act-20

The European Semiconductor Manufacturing Company (ESMC) fab project in Dresden represents a tangible step forward. TSMC leads the joint venture alongside Bosch, Infineon, and NXP. The plant will produce chips on 28/22nm and 16/12nm nodes—technologies heavily used across the automotive and industrial machinery sectors. Production is scheduled to commence by late 2027[12]. While it will not produce leading-edge logic chips, it addresses vital supply requirements for Europe's core industrial base.

The Dresden facility helps translate the concept of European strategic autonomy into practice. The EU does not need to replicate every segment of the supply chain or manufacture every chip type domestically. Instead, it must pinpoint dependencies capable of crippling key industries, safeguard its existing technological strongholds, and secure alternative supply lines for critical components. In this respect, Europe's strategy mirrors the US focus on enhancing independence, even if it operates from a different baseline of industrial capabilities.

Regulatory authority is a key component of European power, but regulation alone is insufficient. Europe requires commercially viable firms, operational fabs, cutting-edge R&D, and a skilled workforce. Otherwise, technological sovereignty risks remaining a mere regulatory goal. Furthermore, transatlantic alignment does not eliminate structural friction: unilateral policy decisions in Washington can constrain European firms and restrict their commercial flexibility.

Europe must strategically choose where to concentrate its resources. It should reinforce sectors backed by a strong industrial base while bridging the gap between research excellence and commercial production. Furthermore, the EU must align its industrial, trade, energy, educational, and defence policies. Securing a new fab is a positive step; integrating it into a resilient ecosystem capable of sustaining it over time is decisive.

From Efficiency to Resilience

The globalisation of the silicon industry yielded clear economic benefits. It lowered production costs, accelerated technological progress, and disseminated

[12] TSMC. European Semiconductor Manufacturing Company (Dresden): 28/22 nm and 16/12 nm technologies, with production expected by the end of 2027. Accessed: 12 August 2026. Available at: https://pr.tsmc.com/english/news/3049

technologies that transformed the global economy. Corporate leaders and policymakers operated on the assumption that global supply chains would run smoothly, free from geopolitical friction, and that components would always be readily available. The pandemic and rising geopolitical rivalries exposed the fragility of those assumptions.

However, the current policy response risks swinging too far in the opposite direction. Duplicating every stage of production in every region would inflate capital costs, drain public resources, and risk creating widespread market overcapacity. Resilience requires a clear understanding of structural dependencies and the development of contingency options for vulnerable nodes. Pursuing complete independence is unrealistic.

Moreover, not all dependencies carry the same degree of risk. Frontier chips—the most advanced logic processors—power artificial intelligence and supercomputing platforms. Meanwhile, legacy node chips, manufactured on mature processes, remain essential for motor vehicles, power grids, defence hardware, and industrial machinery. The pandemic delivered a straightforward lesson: a low-cost, mature component can bring an entire industry to a standstill if it sits at a critical bottleneck.

A sound resilience strategy must blend supplier diversification, international partnerships with trusted allies, component substitution capabilities, and strategic stockpiling. It also requires cultivating technical talent and formulating robust contingency plans. For defence platforms and critical infrastructure, supply chain security must be factored in right from the design phase. When a system relies on a component with no viable substitute, strategic vulnerability exists from the outset.

In the long run, technological power will not belong solely to the state that manufactures the smallest transistor. It will depend equally on the ability to integrate innovations, maintain sustained production, and adapt hardware designs under pressure. Developing a breakthrough technology is a notable achievement; maintaining, scaling, and refining it under geopolitical stress is what translates technological achievement into strategic power.

The Power of Chokepoints

Semiconductors offer multiple avenues for geopolitical leverage. Sales bans on

chips or capital equipment are the most visible tools, but subtler mechanisms exist. Software licensing, technical maintenance, spare parts supply, intellectual property rights, software updates, and technical standards can constrain a fab's operations for years. Similarly, restricting access to key chemical inputs can paralyse a facility even if the primary equipment is fully operational. Possessing hardware and human resources does not automatically guarantee full operational autonomy.

Henry Farrell and Abraham Newman term this coercive use of global economic networks 'weaponised interdependence'[13]. The semiconductor industry fits this model well. An actor occupying a central node in a global network can monitor the flows passing through it and, in certain circumstances, restrict or condition access for rival states.

Yet, this form of power carries inherent limitations. Targeted states face powerful incentives to eliminate their dependencies whenever those dependencies are weaponised against them. Technological coercion can delay rival programmes and raise their operational costs, but its long-term efficacy diminishes against a strategic competitor possessing sufficient scientific, financial, and industrial resources to engineer alternatives.

Broad restrictions can also harm domestic companies in the issuing state by cutting them off from important commercial markets, thereby reducing revenues that could fund future investment and research. While overly permissive policies risk unintended technology transfer, excessive restrictions can degrade the very industrial ecosystem they seek to protect. Balancing national security concerns with commercial competitiveness requires careful calibration.

Export controls must remain selective, closely coordinated with international allies, and regularly reassessed. Critical bottlenecks are not static; emerging materials, novel chip architectures, and advanced packaging techniques will continuously reshape the structure of the supply chain over time.

[13] Farrell, Henry and Newman, Abraham L. «Weaponized Interdependence: How Global Economic Networks Shape State Coercion», International Security, vol. 44, no. 1, 2019, pp. 42-79. DOI: 10.1162/isec_a_00351. Available at: https://direct.mit.edu/isec/article/44/1/42/12237/Weaponized-Interdependence-How-Global-Economic

Strategic Implications

This analysis points to several strategic implications for future technology and security policy.

Economic security is now deeply intertwined with national security. A prolonged interruption in semiconductor supplies would severely impact industrial manufacturing, telecommunications, energy distribution, transport networks, and military readiness.

Strategic autonomy will be inherently shared. The United States requires European and Asian industrial capabilities; Europe remains reliant on foreign design and manufacturing capacity; China still depends on key foreign technologies. Building robust technological alliances between states and secure supply agreements between firms will prove just as crucial as direct domestic investment.

The digital economy has not escaped physical realities. Fabs cannot be constructed anywhere: they require specialised suppliers, reliable power grids, vast quantities of water, raw materials, logistics infrastructure, and digital connectivity. The physical location of these assets determines their exposure to political, military, or supply chain crises. Access to raw materials and critical infrastructure has become a central arena of modern geoeconomic competition[14].

The dynamic between state authorities and private enterprise is evolving. Key strategic assets remain in the hands of commercial firms accountable to shareholders and market forces. Conversely, governments increasingly demand corporate decisions that align with national security priorities. Disputes over fab locations, export controls, and technology transfers will highlight this divergence of interests.

Technological power is accumulated over long horizons. It demands sustained investment in universities, fundamental research, venture capital, vendor networks, market demand, top talent, and policy continuity. A government subsidy can accelerate growth, and a new fab can strengthen capacity, but neither can create a

[14] Belmonte Sánchez, María Teresa et al. «Groenlandia: Un nuevo paradigma en el escenario geopolítico mundial», IEEE Opinion Paper 96/2025, 20 November 2025. Accessed: 12 August 2026. Available at: https://www.defensa.gob.es/ceseden/-/ieee/groenlandia-un-nuevo-paradigma-en-escenario-geopolitico-mundial

competitive ecosystem overnight.

Conclusions

Semiconductors have established themselves as a central strategic resource of the twenty-first century. They underpin economic output, technological innovation, and national defence. Their geopolitical weight stems principally from a supply chain defined by highly concentrated, hard-to-replace functional nodes.

International specialisation enabled an extraordinarily efficient global industry and drove unprecedented technological progress. However, it also concentrated critical capabilities within a small handful of corporations and geographic regions. The pandemic exposed the vulnerability of this model to unexpected supply disruptions. Subsequently, escalating US–China rivalry transformed these supply chain vulnerabilities into a major geopolitical issue.

Major global actors are working to address their vulnerabilities from distinct starting points. Washington combines industrial subsidies with export controls designed to restrict Chinese access to cutting-edge technologies. Beijing is mobilising state resources to foster domestic champions and build a less dependent industrial ecosystem. The European Union is striving to protect its niche strengths while reclaiming lost manufacturing capacity. None of these players is likely to achieve complete autonomy. Strategic advantage will depend on the strategic value of the nodes an actor controls, the availability of alternative supply lines, and the capacity to maintain vital state functions during a crisis.

Reindustrialisation policies are already altering the global landscape, particularly in the United States. Constructing an individual fab mitigates specific supply risks depending on the chip types produced. However, it alters a nation's strategic standing over the long term only when integrated into a well-developed local ecosystem backed by reliable suppliers, cutting-edge R&D, and steady market demand. Sustaining public subsidies, maintaining commercial profitability, and avoiding structural overcapacity will require ongoing policy evaluation.

Technological export controls can delay a strategic competitor and safeguard sensitive capabilities, but their effectiveness wanes over time unless reinforced by continuous internal innovation. Maintaining a strategic edge requires widening the

technological and manufacturing gap; simply denying a rival access to existing technologies is no longer enough.

This lesson extends far beyond the semiconductor sector. Critical technologies have become central to calculations of national power because they underpin an ever-expanding array of civil and military capabilities. While semiconductors represent the most visible battleground today, other sectors featuring highly concentrated global supply chains could soon follow a similar trajectory. Understanding their physical and material foundations has become a prerequisite for political autonomy.

Total self-sufficiency is an unrealistic objective. Policymakers should focus instead on securing freedom of action and maintaining strategic flexibility in the face of potential supply restrictions. This requires mapping existing dependencies, mitigating the most dangerous vulnerabilities, and preparing alternative supply pathways well before a crisis hits. A state's ability to maintain freedom of action under pressure defines the strategic dimension of the semiconductor.

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