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EUROPEAN STRATEGIC AUTONOMY: TECHNOLOGY, CRITICAL INFRASTRUCTURE AND STRATEGIC DEPENDENCIES

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The strategic importance of technologies, infrastructures, data and supply chains is increasing in the emerging international order. Taking as background the European goal to reduce strategic vulnerability, this article proposes a framework linking technological capability, strategic dependency, power asymmetry, strategic autonomy and international position.

The international order is being transformed not only by changes in military and economic capabilities, but also by the strategic importance of technologies, infrastructures, data and supply chains. Digital networks, cloud services, semiconductors, satellite systems, artificial intelligence and cybersecurity increasingly underpin economic activity, public administration, defence and essential services. The capacity to develop, access, protect and control critical technologies is therefore connected to the capacity of states and regional organisations to preserve freedom of action.

The European Union combines substantial scientific, industrial, regulatory and market capabilities with significant external technological dependencies. Recent European initiatives on technological sovereignty explicitly connect technological capability with competitiveness, resilience and strategic autonomy. The strategic question is not whether interdependence can be eliminated, but whether critical dependencies are sufficiently diversified, substitutable and resilient to remain compatible with freedom of strategic choice. The central argument is that technological dependence becomes strategically consequential when an essential capability is concentrated, difficult or slow to replace, and capable of imposing significant costs on strategic decision-making. Critical infrastructure is the principal interface through which this relationship becomes visible: dependence on external technologies, suppliers, platforms, standards or services can become infrastructural vulnerability and, under crisis conditions, a constraint on political choice.

The analysis adopts a qualitative, theoretical-analytical and documentary approach, combining international relations and se-

curity literature with recent European and NATO developments. It proposes a Technology–Dependency–Power–Autonomy Framework linking technological capability, strategic dependency, power asymmetry, strategic autonomy and international position. The framework is analytical rather than deterministic: substitutability, switching time, resilience and redundancy condition the strategic effects of dependency.

Technology as a component of international power

Power in international relations is not static. Military and economic capabilities remain fundamental, but technological change alters the resources through which influence is exercised and the infrastructures through which those resources circulate. Technology should therefore be understood as a relational and structural component of power that can reinforce military, economic, diplomatic and informational capabilities (Strange, 1988).

Strategic relevance depends not only on what a technology can do, but also on who designs it, produces it, maintains it, sets standards for it and controls access to it.

Interdependence can generate mutual benefits while also producing asymmetric vulnerabilities. Keohane and Nye (2012) show that reciprocal effects may create significant costs, while Farrell and Newman (2019) demonstrate how actors occupying central positions in global networks can acquire coercive and informational leverage. The relevant question is

consequently not whether dependence exists, but under what conditions it becomes strategically consequential.

This logic is particularly important for semiconductors, cloud infrastructure, satellite systems, cybersecurity and artificial intelligence. These technologies are enabling layers for other capabilities. An actor may exercise influence not by directly controlling a political decision, but by controlling a component, platform, standard, infrastructure, data environment or supply chain on which that decision depends.

The international significance of technology is therefore relational. Strategic relevance depends not only on what a technology can do, but also on who designs it, produces it, maintains it, sets standards for it and controls access to it. This extends the analysis of power from ownership of material assets to structural position within technological ecosystems.

Critical infrastructure and strategic dependencies

Critical infrastructure provides the clearest illustration of the relationship between technology and strategic dependence. Energy, transport, telecommunications, finance, health and digital services increasingly depend on interconnected technological systems. Disruption in one component can propagate across organisational and sectoral boundaries.

Strategic dependency can be considered across four dimensions: supply dependency, technological dependency, infrastructural dependency and knowledge or skills dependency. These dimensions may overlap. Dependence on a supplier can become more consequential when the associated technology is proprietary, difficult to integrate with alternatives, dependent on specialised expertise, or embedded in a wider ecosystem.

Dependence does not automatically equal vulnerability. External inputs can increase efficiency, innovation and resilience when alternative suppliers, interoperable systems and contingency arrangements exist. The strategic problem is unmanaged dependence: a condition in which concentration, lack of substitutes, long replacement times or high disruption costs reduce freedom of action.

For this reason, two variables deserve particular attention. The first is substitutability: whether a credible technical, commercial and organisational alternative exists. The second is switching time: how long it would take to migrate from an existing technology, supplier or infrastructure without unacceptable disruption. A nominal alternative may have little strategic value if certification, procurement, integration, skills or physical deployment require years.

The European Commission's recent approach to technological sovereignty reflects this broader understanding. Technological sovereignty is connected with the ability to develop and control critical capabilities, but also with resilience, open strategic cooperation and the capacity to manage dependencies. Strategic autonomy is therefore not synonymous with technological autarky.

From technological dependence to strategic autonomy

Strategic autonomy is best understood as a capacity rather than a condition. It refers to the ability to make and implement strategic decisions while retaining sufficient freedom of action when external pressure, uncertainty or disruption occurs. This conception avoids equating autonomy with self-sufficiency.

Technological sovereignty is one component of that capacity. It concerns the ability to develop, control, secure or influence critical technologies and technological ecosystems. Strategic autonomy is broader: it also depends on institutions, industrial capacity, infrastructure resilience, financial resources, standards, alliances and decision-making capacity.

The distinction matters because complete technological separation would often be economically inefficient and strategically unnecessary. European autonomy can instead be strengthened through diversification, interoperability, common standards, joint procurement,

research cooperation and partnerships, provided that critical dependencies are understood and managed.

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Critical infrastructure resilience is consequently part of strategic autonomy. Resilience involves anticipation, redundancy, alternative supply routes, continuity arrangements, recovery capacity and institutional learning. These mechanisms reduce the likelihood that a technological dependency will become a decisive constraint during a crisis.

Europe in the emerging international order

The emerging international order is characterised by increasing competition over technology, standards, supply chains, data and industrial ecosystems. Recent European policy developments concerning semiconductors, cloud, artificial intelligence, open source and digital sovereignty reflect the recognition that technological capability has become connected to geopolitical position.

The issue is not whether Europe should choose between dependence and independence. The more useful distinction is between manageable and strategically consequential dependence. Europe can remain deeply integrated with the United States, China and other major economies while seeking to reduce concentration in areas where interruption would impose disproportionate strategic costs.

This approach also changes how international position should be assessed. Technological capability matters strategically when it can be converted into decision and action. An actor with advanced research but excessive external dependence may possess technological excellence without equivalent strategic freedom. Conversely, diversified access, interoperability and resilience can transform interdependence into a more manageable strategic condition.

The resulting challenge is not technological separation, but managed interdependence. Europe does not need to dominate every strategic technology. It needs sufficient capability to understand, evaluate, secure and, where necessary, diversify or replace critical inputs. This is particularly important where technology underpins essential services and national or European security.

The technology–dependency–power–autonomy framework

The preceding analysis can be synthesised in an analytical chain:

Technological Capability → *Strategic Dependency* → *Power Asymmetry* → *Strategic Autonomy* → *International Position*.

FIGURE 1. TECHNOLOGY–DEPENDENCY–POWER–AUTONOMY FRAMEWORK

Source: Author's elaboration.

Dimension	Analytical question	Strategic implication
Technological capability	What can Europe develop, access, deploy and secure?	Available strategic capacity
Strategic dependency	Which essential capabilities depend on external actors or systems?	Potential exposure
Power asymmetry	Who controls production, infrastructure, standards or access?	Potential leverage
Substitutability / switching time	Can an alternative be activated, and how quickly?	Degree of strategic constraint
Resilience / redundancy	What alternatives and continuity mechanisms exist?	Mitigation of vulnerability
Strategic autonomy	Can decisions be made and implemented under pressure?	Freedom of strategic action
International position	Can capability be converted into strategic choice?	Influence within the emerging order



Three conditioning variables – substitutability, switching time and resilience – determine whether dependency is likely to translate into strategic vulnerability.

The framework yields four propositions. First, technological capability is increasingly part of international power because it underpins multiple domains of state and societal capacity. Second, dependence becomes vulnerability only when concentration, low substitutability, long switching time or high disruption consequences create meaningful constraints. Third, strategic autonomy should be assessed through freedom of action rather than the absence of interdependence. Fourth, resilience can moderate the conversion of dependency into strategic leverage.

The framework also clarifies why access is not equivalent to control. A European operator may have continuous access to a technology while remaining strategically dependent if the supplier controls maintenance, updates, standards, data, certification or replacement. Similarly, formal ownership of infrastructure does not necessarily imply effective control over its technological ecosystem.

The framework is deliberately conceptual. It does not establish a universal measurement model and requires empirical testing through sectoral case studies and indicators of concentration, substitutability, switching time and resilience.

Strategic implications

The policy implication is that Europe should assess critical technologies not only according to performance and economic value, but also according to their dependency profile. Procurement and infrastructure planning should consider concentration, interoperability, alternative suppliers, maintenance dependencies, skills, certification and realistic replacement time.

Public-private cooperation is essential because much critical infrastructure is privately operated. Strategic resilience therefore requires information sharing, supply-chain visibility, continuity planning and technical expertise within public authorities. European cooperation can increase bargaining capacity and reduce fragmented dependencies, while international partnerships can provide access to technologies and markets.

The objective should not be to eliminate interdependence. It should be to ensure that interdependence does not become an involuntary constraint on strategic choice. This requires a balance between innovation, openness, resilience and selective technological capability.

Conclusion

Technology is increasingly embedded in the material and institutional foundations of international power. For Europe, critical infrastructure exposes the strategic consequences of this transformation because essential services depend on global technological ecosystems.

The central issue is not dependence itself, but unmanaged dependence. Where critical capabilities are concentrated, difficult to substitute and slow to replace, technological dependence may create power asymmetries and constrain strategic autonomy. Where dependencies are diversified and supported by interoperability, redundancy and institutional capacity, interdependence can remain compatible with freedom of action.

European strategic autonomy should therefore be understood as the capacity to preserve meaningful strategic decision and action while managing unavoidable technological and infrastructural dependencies. The Technology-Dependency-Power-Autonomy framework provides a way to connect technological capability with international position without assuming that dependence automatically produces vulnerability.

In the emerging international order, Europe's position will depend not only on its ability to innovate, but also on its ability to decide where dependence is acceptable, where redundancy is necessary, where cooperation increases resilience and where technological capability must be protected as a strategic asset. ●

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References

- Buzan, B. G., Wæver, O., & de Wilde, J. (1998). *Security: A new framework for analysis*. Lynne Rienner Publishers.
- Couto, A. C. (1988). *Elementos de estratégia: Apontamentos para um curso* (Vol. 1). Instituto de Altos Estudos Militares.
- European Commission. (2026). *2026 State of the Digital Decade package*. European Commission.
- European Commission. (2026). *Communication on European Tech Sovereignty, accompanied by an EU Open Source Strategy* (COM(2026) 503 final). European Commission.
- European Innovation Council and SMEs Executive Agency. (2026). *EIC Tech Report 2026: Emerging deep tech signals for Europe's strategic autonomy and resilience*. European Commission.
- European Parliament & Council of the European Union. (2022a). Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive). *Official Journal of the European Union*, L 333, 80-152.
- European Parliament & Council of the European Union. (2022b). Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC. *Official Journal of the European Union*, L 333, 164-198.
- Farrell, H., & Newman, A. L. (2019). Weaponized interdependence: How global economic networks shape state coercion. *International Security*, 44(1), 42-79. https://doi.org/10.1162/isec_a_00351
- García-Herrero, A., & Rühlig, T. (2026). *China – A fragile power? How Europe can use its economic leverage over Beijing* (Chaillot Paper No. 188). European Union Institute for Security Studies. <https://doi.org/10.2815/9883794>
- Keohane, R. O., & Nye, J. S. (2012). *Power and interdependence* (4th ed.). Longman.
- NATO. (2026a). *2026 Resilience Baseline Requirements*. The North Atlantic Treaty Organization.
- NATO. (2026b). *Alliance Digital Strategy*. The North Atlantic Treaty Organization.
- Strange, S. (1988). *States and markets*. Pinter Publishers.