Geopolitical Fragmentation and the Reconfiguration of Global AI Value Chains: India's Strategic Technological Choices

Dr. Seema Singha[1], Dr. Subhash Sinha[2] Satyajit Kairi[3], Sumit Sinha[4]

[1]Research Scholar. Assam University, Silchar, Assam, India, Email Id: seemasingha87@icloud.com, Orcid id- 0000-0001-7880-0831
[2]Assistant Professor & Head, Department of Economics, Swami Vivekananda College, Assam, India, Email Id: soobhashsinha24@gmail.com, Orcid id: 0000-0001-9190-2699
[3]Assistant Professor, Department of Economics, Swami Vivekananda College, Assam, India, Email Id: satya14301@gmail.com, Orcid id- 0009-0002-3358-1019
[4]Assistant Professor, Department of English, Swami Vivekananda College, Assam, India, Email Id: sinhasumit252@gamil.com, Orcid id- 0009-0004-1929-5846
*Corresponding author: Dr Subhash Sinha, Email Id: soobhashsinha24@gmail.com

Abstract
Artificial intelligence (AI) is developing within an increasingly fragmented geopolitical environment that is reshaping the international-business architecture through which AI technologies, infrastructure and capabilities are accessed, developed and deployed. This paper examines how geopolitical fragmentation reshapes technological interdependence and the strategic policy space of countries outside the principal technology blocs, using India as the focal case. Drawing on geoeconomics, weaponized interdependence and technological chokepoints, the paper develops a framework linking geopolitical competition and technology restrictions to asymmetric technological dependence and strategic vulnerability. A qualitative, comparative and documentary analysis of evidence from 2019–2026 examines the United States, China and the European Union as functionally differentiated technology-policy configurations and India as the focal case. The analysis shows that fragmentation is selective rather than equivalent to technological decoupling, with India's exposure concentrated at critical upstream nodes characterised by high technological importance, supplier concentration, limited substitutability and external capacity to condition access. The paper develops Strategic Technological Multi-Alignment (STMA), combining partnership diversification, domestic capability-building and technological interoperability. Its strategic value depends on whether these mechanisms increase the substitutability of critical technological pathways. The paper therefore conceptualises strategic autonomy as the capacity to preserve meaningful technological choices under changing geopolitical conditions.

Keywords: Artificial Intelligence; Geopolitical Fragmentation; Technological Chokepoints; Technological Dependence; Strategic Technological Multi-Alignment.

JEL Classification: O33; O38; F50; F52; L86

1. Introduction

Artificial intelligence (AI) is becoming an important component of the global political economy, transforming not only production and trade but also the distribution of technological and geopolitical power. As a general-purpose technology, AI has applications across manufacturing, services, finance, defence, healthcare and public administration, while its development increasingly depends on advanced semiconductors, high-performance computing, cloud infrastructure, data and specialised technological capabilities. The World Trade Organization (WTO, 2025) argues that AI can substantially reduce trade costs, increase productivity and expand international trade, but also warns that unequal access to digital infrastructure, skills and AI-enabling technologies may produce highly uneven benefits. The economic significance of AI is therefore inseparable from questions of technological access and control.

At the same time, the international environment in which AI is developing has changed considerably. The post-Cold War expansion of economic integration is increasingly being accompanied by geopolitical rivalry, economic-security policies and strategic competition over critical technologies. The literature on geoeconomics highlights how states increasingly employ trade restrictions, sanctions, investment controls and other economic instruments to pursue strategic objectives (Petry, 2024; Reddy & Rani, 2026; Wigell & Hadi, 2026). This development has important implications for technologies whose production networks are geographically and institutionally concentrated.

Farrell and Newman's (2019) concept of weaponized interdependence provides a useful theoretical lens for understanding this transformation. Global networks are not structurally neutral: certain firms,

infrastructures and jurisdictions occupy central positions through which economic and technological flows are channelled. Control over such nodes can create strategic leverage through information advantages or the ability to restrict access to critical networks (Farrell & Newman, 2019). Subsequent research demonstrates that this logic extends to private digital infrastructure and semiconductor networks, where the concentration of critical capabilities can create potential chokepoints and expose downstream actors to geopolitical pressure (Gjesvik, 2022; Beaumier & Cartwright, 2024; Baines et al., 2026).

AI intensifies this problem because its development depends upon a relatively concentrated technological infrastructure. Advanced AI systems require specialised computing, advanced semiconductor manufacturing and access to sophisticated digital infrastructure. Consequently, AI-related dependence is increasingly determined not simply by trade volumes but by access to specific upstream technologies. Weymouth (2025) characterises this emerging process as digital disintegration, whereby states seek greater control over critical elements of the AI value chain through export controls, infrastructure partnerships and restrictions on foreign digital platforms. The resulting technological environment is increasingly organised around competing techno-blocs rather than an entirely open and integrated digital economy.

This development is particularly visible in the strategic competition between the United States and China. Advanced semiconductors, semiconductor manufacturing technologies and computing capabilities have increasingly become subjects of national-security policy. US export controls have sought to constrain China's access to selected advanced semiconductor technologies, while China has responded with efforts to strengthen domestic technological capabilities and develop alternative innovation pathways (Milutinović & Nikolić, 2023; Shrivastava & Jash, 2025; Yu, 2025). The resulting interaction illustrates broader feedback mechanism: attempts to exploit technological dependence can encourage targeted states to pursue technological substitution, diversification and self-reliance. AI trade policy therefore increasingly operates at the intersection of commercial exchange, industrial policy and geopolitical strategy.

The consequences extend beyond the United States and China. Geopolitical fragmentation does not necessarily imply complete technological decoupling. Instead, international production and trade may be reorganised through geopolitical blocs, connector economies and diversified supply chains. Gopinath et al. (2024) document increasing divergence in trade and investment patterns between geopolitically distant economies while identifying continued economic connectivity through intermediary countries. Similarly, Schindler and Rolf (2024) show how US–China rivalry is reshaping corporate strategies and the organisation of the global economy. The emerging system is therefore characterised by selective fragmentation: economic interdependence persists, but its structure and strategic meaning are changing.

This transformation creates a distinctive challenge for countries that are neither dominant technology powers nor technologically isolated economies. Middle powers must maintain access to global technologies while reducing exposure to strategically vulnerable dependencies. Research on strategic hedging and technological competition suggests that such countries can preserve policy space by maintaining relationships with multiple centres of power rather than committing exclusively to one technological bloc (Vinodan & Kurian, 2024; Zhang & Khanal, 2024; Tran, 2026). Yet diversification of external partnerships does not necessarily produce technological sovereignty if critical upstream technologies remain concentrated in a small number of foreign firms and jurisdictions.

India provides an important case for examining this dilemma. India has substantial strengths in software, digital services, technical human capital and digital public infrastructure, while simultaneously depending on international markets and foreign suppliers for several advanced technological inputs. Its position has therefore become increasingly important as global firms seek to diversify supply chains and as governments reassess the geographical concentration of strategic technologies. India's strategic-autonomy literature emphasises the country's attempt to maintain policy flexibility through multiple international partnerships rather than relying on a single geopolitical alignment (Mukherjee, 2020; Vinodan & Kurian, 2024; Magunna, 2025; Dash, 2026).

The Indian policy response also increasingly treats AI as a strategic technological capability. The Government of India approved the IndiaAI Mission in March 2024 with an outlay of ₹10,371.92 crore, covering compute capacity, foundation models, datasets, applications, future skills, startup financing and safe and trusted AI (Ministry of Finance, Government of India, 2026; Press Information Bureau, 2026c). The policy objective is therefore not limited to AI adoption; it encompasses the development of a broader domestic ecosystem. The Economic Survey 2025–26 similarly argues that India's AI strategy should reflect its own economic conditions, noting constraints related to capital, computing capacity, energy and infrastructure and emphasising bottom-up, sector-specific applications, open and

interoperable systems, human capital and institutional coordination

These developments create an important analytical tension. India's growing engagement with multiple technology partners can provide access to capital, infrastructure, knowledge and markets, while domestic capability-building can reduce exposure to external technological shocks. However, strategic autonomy may remain constrained when critical components of the AI value chain—particularly advanced computing and semiconductor technologies—are concentrated outside India. The central issue is therefore not whether India should integrate with or withdraw from global technology networks. Rather, it is how India can preserve strategic policy space while remaining embedded in an increasingly fragmented technological system.

Existing scholarship provides important but largely separate explanations of this problem. The literature on weaponized interdependence explains how network centrality can generate geopolitical leverage (Farrell & Newman, 2019; Gjesvik, 2022). Research on geoeconomic fragmentation examines the restructuring of trade, investment and global production around geopolitical considerations (Aiyar et al., 2023; Gopinath et al., 2024). Emerging research on AI identifies semiconductors, computing infrastructure and digital platforms as strategically significant technological nodes (Weymouth, 2025; Papyshev & Chan, 2026). Meanwhile, research on India focuses on strategic autonomy, hedging, multi-alignment and technological capability building (Mukherjee, 2020; Vinodan & Kurian, 2024; Jash & Anand, 2026). What remains comparatively underexplored is the intersection of these literatures: how geopolitical fragmentation of AI-related trade and technology networks affects India's strategic autonomy and technological choices.

This paper addresses that gap by examining the emerging global AI-enabling technology order through the combined lenses of geoeconomics, weaponized interdependence, technological chokepoints and strategic autonomy. Rather than treating AI as a conventional traded commodity, the paper examines the cross-border technological relationships through which AI capabilities are enabled, including export controls, semiconductor policies, investment restrictions, access to computing infrastructure, digital platforms and technology standards. The analysis therefore focuses on the fragmentation and reorganisation of AI-enabling technological networks rather than attempting to estimate an aggregate measure of AI trade fragmentation.

The paper makes three contributions. First, it connects the literature on weaponized interdependence with the emerging political economy of AI by focusing on the technological nodes through which geopolitical power can be exercised. Second, it interprets US–China technological rivalry as part of a wider process of AI-related geoeconomic fragmentation, rather than as an isolated bilateral technology conflict. Third, it uses India to examine how a major emerging economy can respond to fragmented technological interdependence through a combination of multi-alignment, technological diversification and domestic capability building. This paper therefore asks: How does geopolitical fragmentation reshape the international-business architecture of AI, and how does technological dependence at critical AI-enabling nodes affect the strategic choices of countries outside the principal technology blocs?

2. Literature Review

2.1 Geoeconomics and Weaponized Interdependence

The literature on geoeconomics highlights the growing use of economic instruments for strategic purposes. Trade restrictions, sanctions, investment controls and export controls increasingly operate alongside conventional diplomatic and security instruments. This development challenges the assumption that economic interdependence necessarily produces mutual gains and political cooperation. Instead, asymmetric interdependence can create opportunities for states to exercise structural power over economically dependent actors (Reddy & Rani, 2026; Petry, 2024; Wigell & Hadi, 2026).

Farrell and Newman's (2019) concept of weaponized interdependence provides the principal theoretical foundation for understanding this process. They argue that global networks tend to develop asymmetric structures in which certain nodes become substantially more central than others. States exercising jurisdiction over these central nodes can exploit network dependence through two mechanisms: the panopticon effect, involving privileged access to information, and the chokepoint effect, through which access to critical networks can be restricted or denied (Farrell & Newman, 2019). Subsequent research emphasises that such network power is mediated by private firms and domestic institutions, making state–corporate relations an important determinant of the effectiveness of economic coercion (Gjesvik, 2022).

The semiconductor industry illustrates this mechanism particularly clearly. Beaumier and Cartwright (2024) show that states can derive strategic leverage from their positions across interconnected networks, while Baines et al. (2026) demonstrate the spatial and institutional constraints

involved in attempts to weaponize semiconductor interdependence. These studies suggest that technological power depends not simply on the volume of trade but on control over strategically central nodes. At the same time, weaponization has limits: diversified markets, alternative suppliers, private-sector interests and domestic political constraints can reduce the effectiveness of coercion (Farrell & Newman, 2019; Gjesvik, 2022; Miailhes, 2026; Jaknanihan, 2026).

Weaponized interdependence can consequently generate counter-adaptation. Targeted states may diversify suppliers, develop alternative infrastructures, strengthen domestic capabilities or establish new economic networks (Cha, 2023; Ruggi, 2023; Danzman & Meunier, 2024). Thus, the exercise of network power can itself encourage attempts to reduce dependence, creating a feedback mechanism between economic coercion and fragmentation. This provides an important conceptual bridge between geoeconomics and the restructuring of the global economy.

2.2 From Globalisation to Geopolitical Fragmentation

The second strand of literature concerns the transformation of globalisation under increasing geopolitical rivalry. Deglobalisation does not necessarily imply the collapse of cross-border economic activity. Rather, international production, trade and investment may be reorganised according to geopolitical and security considerations (Witt, 2019; Kornprobst & Paul, 2021). The concept of geoeconomic fragmentation captures this shift by emphasising the increasing alignment of economic relationships with geopolitical interests (Aiyar et al., 2023).

Recent empirical evidence indicates that fragmentation is already affecting international economic flows. Gopinath et al. (2024) find significant declines in trade and FDI between geopolitically distant blocs following Russia's invasion of Ukraine, while flows within geopolitical blocs have remained comparatively more resilient. Importantly, their analysis also identifies the growing role of non-aligned connector economies, which can maintain economic links across geopolitical divisions without necessarily eliminating underlying strategic dependence.

From an international-business perspective, these changes matter because geopolitical fragmentation can alter not only the destination of trade and investment but also the organisational strategies through which MNEs manage cross-border technological activities. Firms may respond by diversifying suppliers, relocating selected activities, establishing redundant capacity or restructuring GVC relationships. Consequently, changes in trade and FDI flows provide evidence of network reorientation, but do not necessarily demonstrate a corresponding redistribution of technological control.

US–China strategic rivalry has become an important driver of this restructuring. Governments increasingly combine industrial policy, investment screening, export controls and supply-chain policies with national-security objectives (Aiyar et al., 2023; Schindler & Rolf, 2024). Consequently, firms and governments have increasingly adopted strategies described as de-risking, friend-shoring and supply-chain diversification. The emerging configuration is therefore better understood as selective fragmentation rather than complete deglobalisation.

This process has important implications for technology. Technological standards, semiconductor supply chains, digital infrastructure and data flows are increasingly subject to geopolitical considerations. Weymouth (2025) argues that states are developing forms of strategic digital sovereignty through export controls, infrastructure partnerships and restrictions on foreign digital platforms. Rather than producing complete technological separation, these measures contribute to the emergence of competing techno-blocs.

The literature therefore identifies a paradox: fragmentation can increase resilience by reducing exposure to particular suppliers while simultaneously increasing the costs of international integration and creating new dependencies. Connector economies may benefit from redirected trade and investment, but rerouting does not necessarily eliminate dependence on critical upstream technologies (Gopinath et al., 2024). This distinction is particularly relevant to emerging economies such as India.

2.3 AI, Technological Chokepoints and Strategic Power

Artificial intelligence adds a distinctive technological dimension to geopolitical fragmentation because advanced AI depends on a highly concentrated infrastructure ecosystem. Frontier AI development requires advanced semiconductors, specialised computing capacity, semiconductor manufacturing technologies, cloud infrastructure, data and technical capabilities. Consequently, strategic power in AI is distributed unevenly across the value chain rather than concentrated solely in AI models or applications.

Research on technological interdependence increasingly identifies semiconductors and computing infrastructure as critical nodes. Beaumier and Cartwright (2024) demonstrate how semiconductor networks can generate cross-network forms of

strategic leverage, while Weymouth (2025) places advanced semiconductors, infrastructure and digital platforms at the centre of the emerging techno-bloc structure. The importance of these nodes is reinforced by the growing role of state intervention in AI infrastructure and technology governance.

The resulting technological asymmetries also affect digital sovereignty. Papyshev and Chan (2026), examining the European Union, show that AI regulation involves a strategic trade-off between strengthening domestic technological capacity and retaining access to leading foreign technologies. Their analysis illustrates a broader dilemma faced by technologically dependent economies: regulatory and industrial policies may strengthen domestic capabilities, but complete technological autonomy can be costly where critical technologies remain externally concentrated.

AI therefore transforms the conventional understanding of economic interdependence. Dependence may arise not from aggregate trade volumes but from specific technological chokepoints—inputs or infrastructures for which substitutes are limited and control is concentrated. This creates a direct connection between the weaponized-interdependence literature and the geopolitics of AI. Export controls on advanced semiconductors, restrictions on AI-enabling technologies and competing digital infrastructures can consequently influence the distribution of AI capabilities across countries.

2.4 US–China Technological Rivalry and Fragmentation of AI-Enabling Technology Networks

The US–China technological rivalry represents the clearest contemporary manifestation of this process. Semiconductor technologies, advanced computing and AI have increasingly become subjects of national-security policy rather than conventional commercial policy. US export controls seek to restrict China's access to selected advanced semiconductor technologies, while China has responded by strengthening domestic technological capabilities and developing alternative innovation pathways (Milutinović & Nikolić, 2023; Shrivastava & Jash, 2025; Yu, 2025).

The semiconductor dimension is particularly important because restrictions at upstream nodes can generate downstream effects throughout the AI value chain. Recent research shows that export controls have encouraged Chinese firms and policymakers to pursue technological adaptation, including greater emphasis on domestic capabilities, computing efficiency and alternative AI ecosystems (Shrivastava & Jash, 2025; Wang et al., 2026; Yoon et al., 2026). Thus, technological containment can simultaneously restrict access and stimulate efforts at substitution.

The implications extend beyond the two major powers. Third countries face pressure to navigate competing technology ecosystems while preserving access to global markets and infrastructure. Research on technological rivalry increasingly highlights the role of swing states and strategic hedging, whereby countries seek to maintain relationships with multiple technological centres rather than committing completely to one bloc (Zhang & Khanal, 2024; Tran, 2026). The emerging AI order is consequently characterised by selective interdependence rather than complete decoupling.

This literature establishes that AI trade policy cannot be understood narrowly through tariffs on AI-related goods. It encompasses export controls, semiconductor policies, investment restrictions, digital infrastructure, technology standards and access to computing resources. The US–China rivalry has therefore transformed AI from primarily an innovation and commercial issue into an increasingly geoeconomic domain.

2.5 India and Strategic Autonomy in a Fragmented Technology Order

For India, geopolitical fragmentation presents a simultaneous opportunity and vulnerability. India can potentially benefit from supply-chain diversification, redirected investment and its position as a large technology market and connector economy. At the same time, its dependence on foreign technologies and infrastructure in strategically important areas constrains the extent to which external diversification automatically produces technological autonomy (Gopinath et al., 2024; Yadav, 2024).

India's foreign-policy literature increasingly describes its contemporary approach as strategic autonomy combined with multi-alignment or hedging. Rather than remaining detached from major-power competition, India has expanded cooperation with multiple partners while attempting to preserve independent policy space (Mukherjee, 2020; Vinodan & Kurian, 2024; Dash, 2026; Magunna, 2025). This approach is particularly visible in India's simultaneous engagement with the United States, European Union, Quad, BRICS, G20 and other international platforms.

Technological cooperation has consequently become an important component of India's broader strategic-autonomy strategy. India has sought to strengthen domestic capabilities through initiatives related to digital infrastructure, semiconductor production, defence manufacturing and artificial intelligence while continuing to rely on international technology

networks (Dementiev, 2023; Smorodinskaya & Katukov, 2024; Jash & Anand, 2026; Thakur, 2026). Recent work on India's AI position similarly emphasises the tension between international technological access and the development of domestic capabilities (Wu, 2026).

The literature nevertheless reveals an important distinction between strategic diversification and technological sovereignty. Maintaining relationships with multiple external partners may reduce dependence on any single geopolitical actor, but it does not necessarily remove dependence on critical upstream technologies. India's strategic autonomy may therefore be constrained where advanced chips, semiconductor equipment, cloud infrastructure or other AI-enabling technologies remain concentrated outside the country.

This distinction suggests that the strategic value of multi-alignment cannot be assessed simply by counting the number of external technological relationships that a state maintains. What matters is whether those relationships create technologically substitutable pathways. Strategic hedging and multi-alignment primarily describe the diversification of a state's external political relationships, whereas the present study is concerned with whether diversification changes the technological structure of dependence. The relevant outcome is therefore not the number of partners but the extent to which alternative relationships increase substitutability at critical technological nodes.

2.6 Literature Gap

Existing literature explains geopolitical fragmentation, weaponized interdependence and strategic autonomy largely as separate domains, while international-business research has increasingly examined how geopolitical realignment affects MNEs, global value chains and internationalization. Less attention has been given to how geopolitical fragmentation operates through the technological architecture of AI—particularly through critical, concentrated and difficult-to-substitute technological nodes—and how this reshapes the strategic choices of economies outside the principal technology blocs such as India.

3. Conceptual Framework: From Geopolitical Fragmentation to Strategic Policy Space

This paper develops a framework explaining how geopolitical fragmentation reshapes technological interdependence and, consequently, the strategic policy space available to countries outside the principal technology blocs. The framework links geopolitical competition, technology restrictions, technological chokepoints, asymmetric dependence and strategic vulnerability to the responses of technologically interdependent states. Rather than assuming a linear progression from external restriction to domestic autonomy, it conceptualises technological dependence as dynamic and recursive. Geopolitical interventions can reconfigure technological networks; states may respond through diversification, domestic capability-building and interoperability; and these responses may reduce dependence at some nodes while creating or relocating it elsewhere. Strategic autonomy is therefore treated as a conditional outcome of how technological dependence is reconfigured, rather than an automatic consequence of diversification or capability-building.

Geopolitical competition affects technological interdependence through export controls, investment restrictions, industrial policies, technology-access conditions and other economic-security measures that selectively alter the conditions under which critical technologies are accessed, exchanged and developed. Their consequences depend on the position of the affected technology within the wider AI ecosystem. Technologies that are highly critical but concentrated among a limited number of suppliers or jurisdictions can become strategically consequential because restrictions at these nodes can constrain downstream capabilities. The relevant question is therefore not simply whether a country imports a technology, but whether access to a critical and difficult-to-substitute node can be conditioned by external actors.

A technological chokepoint is defined as a technological node combining four characteristics: high criticality, substantial concentration, limited substitutability and meaningful controllability. Criticality refers to the node's importance for strategically significant technological capabilities; concentration to the extent of supply or control among a limited number of firms or jurisdictions; substitutability to the feasibility of replacing the node with an alternative technology, supplier, infrastructure or production pathway within a relevant time horizon; and controllability to the capacity of firms or jurisdictions occupying the node to condition access through export controls, licensing, investment restrictions, infrastructure governance or related mechanisms. Strategic significance therefore arises from the convergence of these four conditions rather than from technological importance alone.

Where these conditions converge, technological interdependence can become asymmetric. Asymmetric technological dependence arises when a country's ability to maintain or expand critical technological capabilities depends disproportionately on externally controlled technologies, infrastructures or production pathways, while external actors possess

greater capacity to condition access. Such dependence need not imply economy-wide technological weakness: a country may possess substantial capabilities in software, talent, applications or digital infrastructure while remaining exposed at particular upstream nodes. The relevant unit of analysis is therefore the configuration of dependence across the technological value chain, rather than a binary distinction between technological dependence and independence. Strategic vulnerability emerges when exposure to externally controlled nodes constrains technological development, raises substitution costs or narrows feasible policy choices.

For India, this creates a strategic dilemma. International technological integration can provide access to advanced computing, investment, knowledge, infrastructure and markets, while geopolitical fragmentation can increase the strategic significance of the technologies underlying that participation. India can respond through Strategic Technological Multi-Alignment (STMA): maintaining relationships across multiple technological ecosystems while reducing excessive exposure at strategically important nodes through domestic capability-building and technological interoperability. STMA is neither technological self-sufficiency nor a technological equivalent of diplomatic hedging. Whereas conventional hedging concerns positioning among competing geopolitical powers, STMA concerns the configuration and management of technological dependence across competing ecosystems. Its objective is to increase the availability of credible technological pathways rather than eliminate interdependence.

STMA, however, need not reduce dependence at the network level. Diversification may reduce reliance on one supplier while creating dependence on another; domestic capability-building may reduce dependence at one node while increasing reliance on foreign equipment, intellectual property, components or infrastructure elsewhere; and interoperability may itself depend on externally controlled standards or infrastructure. STMA can therefore produce reconfigured technological dependence rather than technological independence. Its strategic significance ultimately depends on whether the resulting configuration increases the number and credibility of substitutable technological pathways. Where substitutability increases sufficiently, strategic vulnerability may decline and policy space expand; where dependence is displaced or reconcentrated, vulnerability may persist or emerge elsewhere.

The framework therefore conceptualises the relationship as a recursive process:

Geopolitical competition

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Policy restrictions and technology controls

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Technological chokepoints

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Asymmetric technological dependence

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Strategic vulnerability

↓

Strategic Technological Multi-Alignment

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Reconfigured technological dependence

↓

Greater or constrained strategic policy space

The final relationship is conditional rather than deterministic. Reconfigured dependence can increase strategic policy space when diversification, domestic capability-building and interoperability generate credible and substitutable technological alternatives. Conversely, policy space may remain constrained when alternative pathways remain technologically dependent, concentrated or externally controllable. The framework therefore includes a recursive feedback mechanism in which reconfigured technological dependence can generate future vulnerability. The response to an existing dependency consequently becomes part of the technological configuration that shapes subsequent exposure.

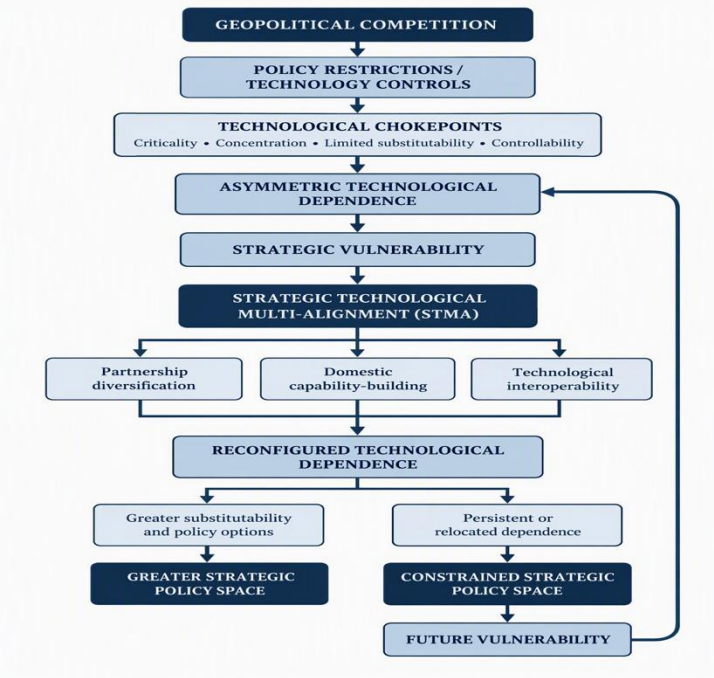


Figure 1. Conceptual framework linking geopolitical fragmentation, technological chokepoints and India's strategic autonomy

Table 1. Conceptual Distinctions among Technological Exposure, Dependence, Vulnerability, Policy Space and Strategic Autonomy

Concept	What it captures	What it does not establish
Technological exposure	Reliance on externally supplied technologies	Strategic vulnerability
Technological dependence	Reliance on external technologies critical to maintaining capability	Geopolitical leverage
Strategic vulnerability	Dependence that can constrain technological choice under external pressure	Actual coercion
Strategic policy space	Range of feasible technological choices available to the state	Complete autonomy
Strategic autonomy	Capacity to preserve meaningful policy choice under external constraints	Technological self-sufficiency

3.1 Theoretical Propositions

Proposition 1: Geopolitical fragmentation and technological exposure

P1: Geopolitical fragmentation is more likely to increase third-country technological exposure when restrictions affect technologically critical nodes characterised by high concentration, limited substitutability and meaningful external capacity to condition access.

Observable implication: Third countries should exhibit greater exposure where geopolitical restrictions affect highly concentrated upstream technologies than where comparable restrictions affect technologies with multiple technically credible suppliers.

Proposition 2: Diversification and dependence

P2: External technological diversification reduces strategic vulnerability only when alternative suppliers, technologies or infrastructures provide substantively substitutable technological pathways rather than merely additional access points to the same upstream dependencies.

Observable implication: Diversification should produce greater strategic flexibility where alternative suppliers rely on technologically independent production pathways, but substantially less flexibility where apparently diverse suppliers remain dependent on the same upstream technologies, standards or jurisdictions.

Proposition 3: Domestic capability and strategic policy space

P3: Domestic technological capability-building is more likely to expand strategic policy space when it occurs at technologically critical nodes where external concentration creates meaningful constraints on policy choice.

Observable implication: Domestic capability-building should have greater strategic significance when it reduces dependence at a critical upstream node than when it expands capabilities in downstream applications that remain dependent on the same external upstream technologies.

Proposition 4: Strategic Technological Multi-Alignment

P4: Strategic Technological Multi-Alignment is more likely to preserve strategic policy space when partnership diversification, domestic capability-building and technological interoperability jointly increase the substitutability of critical technological pathways.

Observable implication: STMA should be associated with greater strategic policy space where its three components increase the number of credible technological pathways available to the state; where they merely redistribute dependence across external suppliers, strategic vulnerability should persist or reappear elsewhere in the technological network.

These propositions are mechanism-oriented rather than statistical hypotheses. Their purpose is to identify the observable conditions under which geopolitical fragmentation is more or less likely to translate technological interdependence into strategic vulnerability, and under which state responses are more or less likely to expand strategic policy space. The empirical analysis therefore evaluates whether the documented evidence is consistent with these conditional mechanisms rather than treating the propositions as statistically tested causal relationships.

4. Research Methodology

This study adopts a qualitative, exploratory and comparative research design to examine how geopolitical fragmentation reshapes AI-related technological dependence and India's strategic policy space. The unit of analysis is the national AI technology-policy regime. The United States, China and the European Union are treated as functionally differentiated comparative cases, while India is the focal case. The United States represents a leading technology ecosystem with substantial capacity to influence access to strategic technologies; China represents a major challenger pursuing domestic capability-building and technological substitution; and the European Union represents a regulatory and industrial-policy configuration seeking technological resilience while remaining integrated into global networks. India is examined because its substantial software, market and technological capabilities coexist with exposure to internationally supplied upstream AI technologies.

The analysis covers 2019–2026 and draws on official policy documents and institutional releases from India, the United States, China and the European Union, supplemented by international organisations and peer-reviewed research on geoeconomics, weaponized interdependence, AI and semiconductor value chains. Evidence is organised around four dimensions: geopolitical fragmentation, technological chokepoints, India's technological exposure, and strategic response.

The empirical analysis is descriptive rather than causal. It does not estimate causal effects or construct a numerical index of technological dependence. Quantitative indicators are used to document infrastructure and capability, while documentary evidence identifies policy restrictions, technological bottlenecks and domestic responses. The analysis distinguishes realised capacity, capability under development and policy intent; these are not treated as equivalent evidence of technological autonomy.

4.1 Operationalisation of technological exposure

Technological exposure is assessed through four dimensions: criticality, concentration, substitutability and controllability.

Criticality refers to the importance of a technological node for maintaining or developing strategically

significant AI capabilities. It is classified as high where disruption could materially constrain important AI capabilities, medium where effects are more limited, and low where strategic effects are limited.

Concentration captures the extent to which relevant production, infrastructure or expertise is controlled by a limited number of firms or jurisdictions. Concentration is high where capability is substantially concentrated, medium where several suppliers exist but important concentration remains, and low where meaningful alternatives are widely distributed.

Substitutability refers to the feasibility of replacing a technology, supplier or production pathway. It is low where technically credible alternatives are limited or costly to adopt, medium where alternatives exist but face significant technological or switching constraints, and high where multiple viable and sufficiently independent alternatives exist.

Controllability refers to the capacity of firms or jurisdictions to condition access through export controls, licensing, investment restrictions, infrastructure governance or technology-transfer restrictions. It is high where credible mechanisms for restricting access exist, medium where such mechanisms are conditional, and low where external actors have limited capacity to condition access.

These dimensions are assessed qualitatively using documentary evidence and coded as low, medium or high. They are not aggregated into a numerical vulnerability index. Their significance lies in their convergence: a node becomes strategically consequential when high criticality, substantial concentration, limited substitutability and meaningful controllability occur together. The analysis therefore distinguishes ordinary technological dependence from strategic exposure and potential vulnerability; it does not infer demonstrated geopolitical leverage from dependence alone.

The analysis proceeds in three stages. First, it compares the policy instruments used by major technology powers. Second, it identifies India's exposure at selected AI value-chain nodes and applies the four-dimensional assessment. Third, it examines whether diversification, domestic capability-building and interoperability increase the substitutability of critical technological pathways. This provides the empirical basis for evaluating the mechanism-oriented propositions developed in Section 3, particularly P2–P4.

5 The Emerging Global AI Technology Policy Regime

The emerging AI policy order is increasingly shaped by three major approaches represented by the United States, China and the European Union. Although their policy instruments differ, all three increasingly treat AI, semiconductors, computing infrastructure and digital platforms as strategically important.

The comparison indicates (table 2) selective rather than complete fragmentation. The United States is using controls at strategically sensitive technology nodes; China is combining domestic capability-building with broad AI diffusion; and the EU is linking regulation to resilience and technological sovereignty. These strategies alter the conditions under which firms and countries access critical technologies while leaving substantial cross-border interdependence intact.

Table 2. Comparative Characteristics of the Emerging Global AI Technology Policy Regimes

Dimension	United States	China	European Union
Strategic orientation	Technological leadership and protection of national-security-sensitive technologies.	Domestic capability-building combined with economy-wide AI deployment.	Regulation, industrial policy and technological resilience.
Core instruments	Export controls, entity-list measures and semiconductor/AI industrial policy.	Domestic capability programmes, AI+ deployment, computing/chip/data support and governance.	AI regulation, semiconductor industrial policy, research support, and cloud/AI initiatives.
Critical technology focus	Advanced computing chips, semiconductor manufacturing technologies and AI	Advanced AI, computing, semiconductors, data and industrial	Semiconductors, AI, cloud infrastructure, data and open/interoperable

Dimension	United States	China	European Union
	diffusion.	applications.	ecosystems.
External dependence	Reduce strategic exposure to rival capabilities while retaining international links.	Reduce vulnerability to external restrictions through domestic substitution and capability-building.	Reduce strategic dependencies while preserving participation in global value chains.
Effect on interdependence	Controls at critical nodes can redirect technology flows and encourage alternative ecosystems.	Domestic substitution can reinforce parallel technological capabilities.	Resilience and regulatory requirements reshape market access without implying full decoupling.

Source: Author's synthesis from Bureau of Industry and Security (2024, 2025), State Council of the People's Republic of China (2025), and European Commission (2026).The table documents exposure at selected critical nodes; it does not estimate a single aggregate dependency ratio.

6. India in the Fragmented AI Economy

India's position combines substantial strengths in software services, technical talent, digital infrastructure and market scale with continued exposure to internationally supplied upstream AI technologies. The evidence therefore suggests selective rather than uniform technological exposure. The purpose of this section is to identify where that exposure is concentrated and whether emerging domestic capabilities alter the structure of dependence.

The assessment covers five nodes: advanced AI compute, semiconductor manufacturing, foundation models, cloud/data-centre infrastructure and specialised AI hardware. The four dimensions developed in Section 4 are applied to each node. In table 3, each rating reflects the documentary evidence presented in the corresponding subsection, with "high" indicating that the relevant condition is strongly supported, "medium" indicating substantial but incomplete evidence, and "low" indicating limited evidence.

Table 3. Assessment of India's Technological Exposure across Critical AI Value-Chain Nodes

AI value-chain node	Criticality	Concentration	Substitutability	Controllability	Exposure
Advanced AI compute/GPUs	High	High	Low	High	High
Semiconductor manufacturing	High	High	Low–Medium	High	High
Foundation models	High	Medium	Medium	Medium	Moderate–High
Cloud/data-centre infrastructure	Medium–High	Medium–High	Medium	Medium	Moderate–High

AI value-chain node	Criticality	Concentration	Substitutability	Controllability	Exposure
Specialised AI hardware	High	High	Low–Medium	High	High

Source: Author's assessment based on Press Information Bureau (2026a, 2026b, 2026c) and IndiaAI (n.d.), using the operationalisation developed in Section 4.

6.1 Advanced AI compute

By June 2026, the IndiaAI Mission had expanded shared compute capacity to more than 45,000 GPUs. In August 2026, the government reported 237 projects receiving subsidised compute support and 93.18 lakh GPU hours sanctioned, while noting that India's current compute ecosystem uses globally sourced GPUs.

Advanced AI compute is therefore highly critical and concentrated, while substitutability remains limited because alternative access points may depend on the same upstream accelerator ecosystem. Controllability is potentially high because access to advanced computing technologies can be conditioned through technology controls. India has consequently expanded domestic access to compute without eliminating upstream dependence on internationally supplied accelerators.

6.2 Semiconductor manufacturing

India's domestic semiconductor capability remains under development, with ten projects approved under the semiconductor programme. Semiconductor manufacturing is high in criticality and concentration, while substitutability is currently low to medium because alternative production requires substantial technological and ecosystem capabilities. Controllability is potentially high because semiconductor technologies are subject to export controls, technology-transfer restrictions and other economic-security measures. Domestic fabrication, packaging and chip-design initiatives can reduce this exposure over time, but approved projects should not be treated as evidence of achieved technological autonomy.

6.3 Foundation models

Twenty indigenous foundation-model proposals had been identified for support by August 2026. Domestic models can reduce dependence on foreign model providers, but frontier development continues to depend on compute and supporting infrastructure. Foundation models are therefore high in criticality but less concentrated than advanced accelerators, with medium substitutability and controllability. Their strategic significance depends on whether domestic model development creates genuinely independent technological pathways rather than downstream capabilities dependent on the same external upstream inputs.

6.4 Cloud and data-centre infrastructure

Installed data-centre capacity was reported at approximately 1,575 MW in 2026. This provides an important basis for AI deployment but should not be interpreted as a direct measure of frontier AI compute capability. AI deployment also depends on specialised compute, energy, networks and capital. The node therefore represents moderate to high exposure, with greater substitutability than advanced semiconductor and accelerator technologies.

6.5 Specialised AI hardware

India is developing indigenous processor and accelerator capabilities, including RISC-V-related initiatives, while high-end accelerators remain internationally sourced. The node is highly critical and concentrated, with currently limited substitutability and potentially high controllability. Domestic initiatives could therefore become strategically important if they develop into scalable and interoperable alternatives rather than remaining isolated design capabilities.

6.6 Cross-node interpretation

The assessment shows that India's technological exposure is concentrated primarily at upstream AI nodes, particularly advanced computing, semiconductors and specialised AI hardware. Domestic initiatives are expanding capabilities, but they do not yet demonstrate technological self-sufficiency. Importantly, the evidence does not establish that external actors have already exercised geopolitical leverage over India. It identifies the structural conditions under which dependence could become strategically consequential.

The central implication is therefore that diversification matters only when it increases technological substitutability. Adding external partners without reducing common upstream dependencies may redistribute rather than reduce vulnerability. Similarly, domestic capability-building is strategically significant when it reduces dependence at critical nodes. India's challenge is consequently not to eliminate technological interdependence, but to create more credible and substitutable pathways within it.

7. Findings and Analysis

The evidence supports five main findings.

7.1 Asymmetric interdependence is concentrated at critical nodes

India's strengths in software, technical talent and digital services do not imply equivalent control over upstream AI inputs. As shown in Section 6, technological exposure is concentrated particularly in advanced computing hardware, semiconductor technologies and other internationally supplied upstream capabilities. These nodes are strategically consequential because their criticality, supplier concentration, limited substitutability and potential controllability can create conditions for strategic vulnerability. However, the evidence does not demonstrate that external actors have already exercised geopolitical leverage over India. It instead identifies the structural conditions under which such leverage could arise.

India is therefore better characterised as experiencing selective technological exposure with potential strategic vulnerability, rather than demonstrated geopolitical coercion. Technological dependence does not automatically generate political leverage; leverage requires dependence to be sufficiently critical, difficult to substitute and subject to political or institutional control (Farrell & Newman, 2019; Beaumier & Cartwright, 2023; Weymouth, 2025). Strategic vulnerability is consequently inferred only where these conditions converge, not from foreign sourcing alone. This distinction separates ordinary technological import dependence from strategically consequential dependence.

7.2 Geopolitical competition is producing selective rather than complete fragmentation

The US–China–EU comparison indicates that geopolitical competition is increasingly embedded in technology, industrial and regulatory policy, but does not demonstrate complete technological decoupling. The United States emphasises controls over strategically sensitive technologies; China combines domestic capability-building with technological substitution and diffusion; and the European Union combines regulation, industrial policy and resilience measures. These approaches reshape access to specific technologies without eliminating cross-border technological interdependence.

The resulting pattern is therefore better understood as selective fragmentation: policy interventions and restrictions reconfigure particular technological relationships while substantial international flows, partnerships and dependencies persist. The evidence thus supports a conclusion about selective fragmentation of AI-enabling technological relationships, rather than a quantified measure of fragmentation in AI trade flows.

7.3 India faces an opportunity–vulnerability paradox

Geopolitical fragmentation can create opportunities for India through redirected investment, supply-chain diversification and expanded technology partnerships, while simultaneously increasing exposure to restrictions or shortages in concentrated upstream technologies. Fragmentation therefore does not automatically strengthen India's technological position. The same restructuring that generates new investment and partnership opportunities can reproduce vulnerability when critical technologies, infrastructure or equipment remain externally concentrated.

India consequently faces a dual process: geopolitical fragmentation may broaden the range of external relationships available to the country while leaving critical upstream dependencies substantially unchanged.

7.4 Strategic autonomy requires managed technological interdependence

The evidence suggests that partnership diversification can widen the conditions for India's strategic policy space, but does not demonstrate that strategic autonomy has already been achieved. India's initiatives in computing, semiconductors, AI models and research are therefore significant insofar as they can reduce exposure at selected critical nodes while preserving external technological connectivity. The strategic objective is not technological self-sufficiency, but the development of more credible and substitutable technological pathways through which dependence can be managed and policy space potentially expanded.

7.5 International-Business Architecture under AI Geopolitical Fragmentation

The evidence suggests that geopolitical fragmentation is not simply altering individual MNE decisions; it is reshaping the international-business architecture through which AI-related production, investment, technology transfer and sourcing are organised.

Geopolitical fragmentation is also reshaping the international business environment in which AI-related MNEs make location, investment and sourcing decisions. As semiconductor, computing and digital-infrastructure policies become increasingly linked to national-security objectives, investment geography is shaped not only by market size, labour costs and technological capabilities but also by access to critical inputs, regulatory compatibility, geopolitical alignment and the reliability of cross-border technology flows. Countries outside the principal technology blocs may therefore attract investment diversification while remaining dependent on upstream technologies controlled elsewhere.

The implications extend beyond FDI volume to its technological content and strategic location. Restrictions can affect technology transfer, access to parent-firm technologies and the organisational forms through which technology is supplied. Investment in semiconductor manufacturing, cloud infrastructure and AI activities may expand India's productive capacity without eliminating technological dependence where critical equipment, intellectual property, advanced components or upstream platforms remain externally controlled. The developmental effect of FDI therefore depends not only on its scale but on whether it builds domestic capabilities and increases the substitutability of critical technological pathways.

Geopolitical fragmentation may consequently reconfigure rather than dismantle global value chains. MNEs may diversify suppliers, relocate selected production or R&D activities, establish additional facilities and develop alternative technological pathways. Such relocation can create opportunities for India without necessarily redistributing control over critical technological nodes. For example, assembly, data-centre capacity or selected R&D may relocate to India while dependence on foreign-controlled semiconductor equipment, advanced accelerators, cloud platforms or intellectual property persists.

India therefore faces a dual international-business positioning problem: it can benefit from MNE diversification while remaining exposed to upstream technologies controlled outside the country. The strategic value of inward investment should consequently be assessed by whether it expands India's technological options, rather than simply increasing the presence of foreign firms. The ability to convert redirected investment into greater strategic policy space will depend on whether it strengthens domestic capabilities, supplier alternatives and technological interoperability at critical nodes. The international-business consequence is therefore not simply a relocation of AI-related activity across countries, but a reconfiguration of the technological conditions under which firms can access, combine and control critical inputs across borders.

8. Strategic Technological Multi-Alignment

Strategic Technological Multi-Alignment is proposed as the paper's analytical interpretation

Strategic Technological Multi-Alignment (STMA) is proposed as an analytical framework for understanding how states can manage technological dependence under conditions of geopolitical fragmentation. It refers to the simultaneous diversification of external technological relationships, development of domestic capabilities at strategically important nodes, and maintenance of interoperability across competing technological ecosystems. Its distinctive feature is not the multiplication of partnerships itself, but the use of technological substitutability as the criterion for evaluating whether those relationships expand strategic policy space.

STMA therefore differs from related concepts in both object and mechanism. Strategic hedging and multi-alignment primarily concern a state's positioning among competing geopolitical powers; technological sovereignty concerns the capacity to retain authority or control over strategically important technologies; and diversification concerns the distribution of external suppliers or relationships. STMA focuses instead on the technological configuration through which dependence is organised. Its central question is whether partnership diversification, domestic capability-building and interoperability jointly increase the number and credibility of substitutable technological pathways available to the state. A greater number of external relationships does not constitute STMA if those relationships remain dependent on the same upstream chokepoints. Conversely, domestic capability contributes to STMA when it reduces exposure at a critical node or increases the feasibility of switching to an alternative pathway.

The strategic objective of STMA is therefore not technological self-sufficiency but increased substitutability of critical technological pathways. A state gains greater strategic policy space when it can access more than one credible technological pathway, develop domestic alternatives at strategically important nodes, and maintain compatibility across technological ecosystems. Conversely, diversification

may have limited strategic value when alternative suppliers depend on the same upstream technologies, when switching costs remain high, or when apparently different technological ecosystems are themselves dependent on a common external chokepoint. STMA should therefore be understood as a conditional strategy rather than an automatic pathway from diversification to strategic autonomy.

For India, STMA provides an analytical interpretation of the attempt to remain internationally connected while reducing exposure at critical technological nodes. India's engagement with multiple technological partners can widen access to capital, infrastructure, knowledge and markets, while domestic initiatives in computing, semiconductors, AI models and digital infrastructure can potentially increase technological options. However, these initiatives do not by themselves establish technological autonomy. Their strategic significance depends on whether they reduce dependence on concentrated upstream technologies and increase the number of credible alternatives available to Indian firms and public institutions. STMA therefore provides a framework for evaluating India's response according to the extent to which it changes the structure of technological dependence rather than simply the number of international partnerships.

The STMA mechanism can therefore be represented as: geopolitical fragmentation → technological exposure → diversification, domestic capability-building and interoperability → increased substitutability → potentially reduced strategic vulnerability → greater strategic policy space. The outcome remains conditional because technological adaptation may also generate new forms of dependence elsewhere in the technological network.

9. Policy Implications

The analysis has four main policy implications for India.

First, India should identify technological dependencies according to their strategic characteristics rather than treating all external technology dependence as equivalent. Dependency mapping should consider at least four dimensions: technological criticality, supplier concentration, substitutability and the capacity of external actors to condition access. This would allow policymakers to distinguish between ordinary international sourcing and dependencies that can become strategically consequential under geopolitical pressure. The objective should therefore be to identify where technological concentration could translate into constraints on India's policy choices, rather than pursuing uniform localisation across the entire AI value chain.

Second, domestic capability-building should be targeted at critical nodes where external concentration and limited substitutability create the greatest strategic exposure. The objective should not be complete localisation of the AI value chain, which may be economically inefficient and technologically unrealistic, but selective strengthening of capabilities that increase India's ability to maintain or switch technological pathways when external conditions change. Semiconductor fabrication, advanced packaging, specialised accelerators, high-performance computing, AI research capabilities and supporting infrastructure may therefore warrant different policy priorities depending on their criticality and substitutability. This approach links industrial policy to strategic vulnerability rather than treating technological self-reliance as an objective in itself.

Third, technological diversification should be evaluated by the alternatives it creates rather than by the number of international partners involved. Multiple foreign suppliers do not necessarily reduce strategic dependence if those suppliers rely on the same upstream technologies, jurisdictions or standards. India's partnership strategy should therefore distinguish between nominal diversification and substantive diversification. The latter occurs when alternative suppliers, technologies or infrastructures provide credible substitutes that can be activated when geopolitical restrictions or supply disruptions affect an existing pathway. This implies that FDI and international technology partnerships should be assessed partly according to whether they expand India's technological option set.

Fourth, India's investment policy should seek not only to attract technology-intensive FDI but also to maximise the domestic technological capabilities generated by such investment. Foreign investment in semiconductors, AI infrastructure, cloud services and related activities can strengthen India's position within reorganising GVCs, but the strategic value of such investment depends on the extent to which domestic firms, research institutions and suppliers gain access to capabilities, knowledge and alternative production pathways. Investment promotion should therefore be connected more closely with technology policy and capability development. The objective is not to replace foreign firms with domestic firms, but to ensure that foreign participation contributes to a broader and more substitutable technological ecosystem.

Finally, India should treat technological interoperability as a strategic capability rather than merely a technical or regulatory objective. Open standards, interoperable infrastructure and compatibility across technological ecosystems can reduce technological lock-in and increase the feasibility of switching between suppliers and

platforms. Interoperability is therefore valuable because it can increase substitutability even when domestic production cannot immediately replace foreign technologies. In a fragmented global technology environment, preserving interoperability can allow India to remain embedded in international innovation networks while retaining greater flexibility in choosing among competing technological pathways.

Taken together, these measures imply a shift from a narrow conception of technological self-reliance toward managed technological interdependence. The relevant policy question is not whether India can eliminate foreign technological dependence, but whether it can prevent dependence on any single critical technological pathway from becoming sufficiently concentrated and difficult to substitute that it constrains strategic policy choice. This requires coordination among technology policy, industrial policy, investment policy and international economic strategy.

10. Conclusion

The global AI economy is being reorganised within an increasingly fragmented geopolitical environment. Competition over advanced semiconductors, computing infrastructure, cloud systems and other AI-enabling technologies is not eliminating technological interdependence but reshaping its structure, concentration and strategic consequences. The central implication is that geopolitical fragmentation becomes particularly consequential when it intersects with technological chokepoints—critical nodes characterised by high technological importance, concentrated control, limited substitutability and the capacity to condition access.

These dynamics extend beyond state-to-state competition by reshaping the environment in which multinational firms make location, sourcing, investment and technology-transfer decisions. Export controls, investment restrictions, industrial policies and technology-security measures can redirect FDI and encourage supplier diversification, creating opportunities for connector economies such as India without necessarily redistributing control over upstream technologies. Relocation of production, computing capacity or selected R&D activities should therefore not be equated with technological decoupling.

India illustrates this tension. Its software capabilities, technical talent, digital infrastructure and market scale create opportunities to attract investment and participate in the reorganisation of global technology networks, while dependence on internationally concentrated advanced computing, semiconductor and other upstream technologies creates selective vulnerability. India's strategic challenge is consequently not to eliminate technological interdependence, but to prevent dependence on critical pathways from becoming so concentrated and difficult to substitute that it constrains strategic policy space.

Against this background, the paper develops Strategic Technological Multi-Alignment (STMA) as an analytical framework combining partnership diversification, domestic capability-building and technological interoperability. STMA does not imply technological self-sufficiency or complete decoupling. Its strategic value depends on whether these mechanisms increase the substitutability of critical technological pathways. Diversification without substantive alternatives may merely redistribute dependence; domestic capability without external technological connectivity may constrain frontier participation; and interoperability becomes strategically valuable when it reduces technological lock-in and facilitates switching between credible alternatives.

The broader theoretical contribution is to shift the analysis of strategic autonomy from the quantity of technological access or partnerships to the structure of technological dependence. Strategic autonomy is therefore understood not as the absence of external dependence, but as the capacity to retain meaningful technological choices when geopolitical conditions change. For India, this requires greater integration of technology, industrial, investment and international economic policies around the critical nodes where concentration and limited substitutability generate the greatest exposure.

The paper does not claim that India has already achieved strategic autonomy or demonstrated geopolitical leverage through technological substitution. Its empirical contribution is instead a conditional assessment of the architecture of India's technological dependence: identifying where dependence is concentrated, why diversification may fail to create genuine alternatives, and under what conditions domestic capability-building and interoperability could expand future policy space.

The central conclusion is therefore conditional: geopolitical fragmentation creates strategic vulnerability where critical technological dependence remains concentrated and difficult to substitute, but it can also create opportunities for states capable of converting diversified access and domestic capability into credible technological alternatives. India's strategic position will consequently depend not simply on how much AI capability it acquires, but on whether that capability expands the range of technological choices available to it within an increasingly fragmented global technology order.

Declaration

Ethics approval and consent to participate

Not applicable. This study does not involve human participants, human data or animals.

Consent for publication:

During the preparation of this manuscript, the author used ChatGPT (OpenAI) for language editing and improving grammatical clarity. The author reviewed and edited the content as necessary and takes full responsibility for the content of the publication.

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