

GLOBAL INFRASTRUCTURE AT THE POINT OF STRUCTURAL DECOUPLING: HOW FRAGMENTATION AND RENATIONALIZATION REDEFINE GEOECONOMIC COMPETITION

ГЛОБАЛЬНА ІНФРАСТРУКТУРА В УМОВАХ СТРУКТУРНОГО ДЕКАПЛІНГУ: ЯК ФРАГМЕНТАЦІЯ ТА РЕНАЦІОНАЛІЗАЦІЯ ПЕРЕОСМISЛЮЮТЬ ГЕОЕКОНОМІЧНУ КОНКУРЕНЦІЮ

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Abstract. The article explores the evolving character of global infrastructure under the accelerating conditions of geoeconomic fragmentation. It examines how the erosion of the previous model of hyperglobalization, the restructuring of international production networks, the weaponization of interdependence and the politicization of global value chains redefine the strategic logic of infrastructure development. The study emphasizes that fragmentation has become a systemic force reshaping patterns of connectivity, financial flows, and investment priorities, while infrastructural decoupling increasingly acts as a mechanism through which states seek to protect national interests and reduce vulnerabilities. The paper analyzes key drivers of fragmentation, including the crisis of multilateral institutions, the resurgence of industrial policy, the intensification of technological rivalry, the rise of economic nationalism, energy insecurity, and differentiated regional responses to global shocks.

Special attention is devoted to the duality of contemporary infrastructural transformations. On the one hand, global connectivity remains a critical foundation for economic development, trade, digitalization, and supply chain efficiency. On the other hand, the strategic behavior of states reflects a growing preference for the renationalization of investment, selective protectionism, the securitization of critical infrastructure, and the construction of parallel networks outside traditional Western-centric systems. This dual process leads to the emergence of competing infrastructural regimes, where global, regional and national interests intersect and frequently collide. The article highlights that competition for control over transport corridors, energy routes, digital platforms, and financial infrastructure increasingly determines the new geoeconomic configuration.

The research demonstrates that infrastructural decoupling is not merely a technical or economic trend but a broader political phenomenon shaped by the logic of power redistribution. Rivalry between major global actors intensifies the fragmentation of rules, standards and technological ecosystems, generating mixed effects for emerging economies and smaller states. Some countries benefit from strategic diversification of partners and new investment windows, while others become more exposed to supply disruptions and asymmetric dependencies. The study shows that the global economy is transitioning towards a hybrid connectivity landscape, where universal integration is replaced by a mosaic of competing blocs, selective partnerships and differentiated institutional architectures.

The analysis identifies several structural consequences of fragmentation for global infrastructure. These include weakened coordination of transnational projects, rising capital costs due to geopolitical uncertainty, a shift towards state-driven financing models, the prioritization of resilience over efficiency and the formation of overlapping spheres of influence. The article argues that investment renationalization has become an essential tool for governments aiming to strengthen autonomy, protect critical assets, reduce strategic exposure and support national development goals. At the same time, fragmentation stimulates new infrastructural coalitions, accelerates the search for alternative corridors and contributes to the reordering of global economic geography.

The findings confirm that infrastructural decoupling is becoming a central feature of the emerging world economy. It reshapes connectivity patterns, transforms strategic behavior, alters institutional frameworks and deepens geoeconomic competition. Understanding these processes is crucial for assessing long-term risks to global stability, investment flows and development trajectories. The article offers a conceptual foundation for interpreting the future of global infrastructure in an increasingly fragmented international environment and provides analytical tools for evaluating scenarios of renationalization, divergence and contested connectivity.

Key words: *global infrastructure, infrastructure project, megaproject, alliance, decoupling, differentiation, concentration, competition, cooperation, coopetition, fragmentation, localization, sanctions, value chains, supply chains, dependency, connectivity, energy sector, energy market, financing mechanisms, financial assets, investments, cluster, transatlantic cluster, Middle Eastern cluster, OPEC*

Анотація. Стаття досліджує змінний характер глобальної інфраструктури в умовах прискореної геоекономічної фрагментації. Аналізується спосіб, в який ерозія моделі гіперглобалізації, реструктуризація міжнародних виробничих мереж, використання взаємозалежності як інструменту тиску та політизація глобальних ланцюгів вартості переозначають стратегічну логіку розвитку інфраструктури. У роботі підкреслюється, що фрагментація перетворилася на системну силу, яка змінює конфігурації зв'язності, фінансових потоків та інвестиційних пріоритетів, тоді як інфраструктурний декапінг дедалі частіше виступає механізмом, за допомогою якого держави прагнуть захистити національні інтереси та зменшити вразливості. У статті розглянуто ключові чинники фрагментації, серед яких криза багатосторонніх інститутів, ренесанс індустріальної політики, посилення технологічного суперництва, зростання економічного націоналізму, енергетична безпека та диференційовані регіональні реакції на глобальні шоки.

Особливу увагу приділено дуальності сучасних інфраструктурних трансформацій, що супроводжують формування конкуруючих інфраструктурних режимів, у яких глобальні,

регіональні та національні інтереси перетинаються та нерідко вступають у конфлікт. У статті підкреслюється, що конкуренція за контроль над транспортними коридорами, енергетичними маршрутами, цифровими платформами та фінансовою інфраструктурою дедалі більше визначає нову геоекономічну конфігурацію.

Дослідження показує, що інфраструктурний декаплінг є не лише технічною або економічною тенденцією, а й ширшим політичним феноменом, сформованим логікою перерозподілу влади. Сутерніцтво між провідними глобальними акторами посилює фрагментацію правил, стандартів і технологічних екосистем, створюючи змішані ефекти для країн, що розвиваються, та для малих держав. Деякі з них отримують вигоди від стратегічної диверсифікації партнерів та нових інвестиційних можливостей, тоді як інші стають більш вразливими до збоїв у постачанні та асиметричних залежностей. Стаття демонструє, що глобальна економіка переходить до гібридного ландшафту зв'язності, у якому універсальна інтеграція поступається місцем мозаїці конкуруючих блоків, вибіркових партнерств та диференційованих інституційних архітектур.

У роботі виокремлено кілька структурних наслідків фрагментації для глобальної інфраструктури. Серед них послаблення координації транскордонних проектів, зростання варності капіталу через геополітичну невизначеність, зсув до моделей державного фінансування, пріоритизація резільєнції над ефективністю та формування перехресних сфер впливу. У статті стверджується, що ренаціоналізація інвестицій стала ключовим інструментом урядів, які прагнуть зміцнити автономію, захистити критичні активи, зменшити стратегічні ризики та підтримати національні цілі розвитку. Водночас фрагментація стимулює появу нових інфраструктурних коаліцій, прискорює пошук альтернативних коридорів та сприяє переформатуванню глобальної економічної географії.

Ключові слова: глобальна інфраструктура, інфраструктурний проект, мегапроєкт, альянс, декаплінг, диференціація, концентрація, конкуренція, кооперація, конкуренція, фрагментація, локалізація, санкції, ланцюги варності, ланцюги постачавок, залежність, зв'язність, енергетичний сектор, енергетичний ринок, механізми фінансування, фінансові активи, фінансові центри, інвестиції, кластер, трансатлантичний кластер, близькосхідний кластер, ОПЕК.

Introduction. The implementation of global infrastructure projects is undergoing an unprecedented transformation driven by geoeconomic fragmentation, technological separation, and the redefinition of resilience as a strategic concept. Evidence provided by the World Bank Infrastructure Monitor (*World Bank, 2025*) reveals profound shifts in the architecture of investment flows and logistics networks, which collectively shape a new reality of global development. An analysis of these trends demonstrates how fragmentation is transforming not only the geography of capital but also the strategic logic of infrastructure development in a multipolar world.

The World Bank Infrastructure Monitor (*World Bank, 2025*) identifies a significant decline in private investment in infrastructure across the Global South, which fell to \$71.5 billion in 2023, the lowest level since 2015. This represents a 40% decrease compared to the peak of \$120 billion recorded in 2017. The decline reflects a structural transformation of the global investment paradigm rather than a cyclical fluctuation. A key factor behind this contraction is the heightened perception of risk resulting from geopolitical instability. Institutional investors, who historically viewed infrastructure as a stable asset class with predictable cash flows, are reassessing risk in the context of sanctions, currency volatility and political uncertainty. According to the Infrastructure Monitor, the average risk premium for infrastructure projects in low- and middle-income countries increased from three hundred fifty to five hundred twenty basis points between 2020 and 2023 (*World Bank, 2025*).

The sectoral distribution of declining investment shows that fragmentation affects industries unevenly. The energy sector experienced the sharpest contraction, with a fifty-two percent decline in private investment due to the uncertainties of the energy transition and the increasing politicization of energy markets. In contrast, telecommunications demonstrated relative resilience with a fifteen percent decline, reflecting the critical importance of digital infrastructure for economic development. Financing mechanisms are also undergoing structural transformation. Traditional project finance based on long-term, low-risk loans is increasingly being replaced by corporate finance and

government-backed guarantees. The share of projects involving multilateral development banks increased from 23 percent to 41 percent, highlighting the growing importance of public risk mitigation mechanisms for mobilizing private capital. This development creates a paradox in which the countries most in need of private investment become disproportionately dependent on public financing.

Regional variations further reveal the complex geography of investment fragmentation. Sub-Saharan Africa witnessed the most severe decline, with private investment falling by 58 percent, while the majority of remaining projects are concentrated in a limited number of states with relatively stable institutions, such as Kenya, Ghana, and Senegal. Latin America exhibits high volatility, with significant disparities between countries; Chile and Uruguay remain attractive destinations for investment, while Argentina and Venezuela are largely excluded from private capital flows. South Asia exhibits relative resilience due to the scale of its domestic markets in India and Bangladesh; however, investment remains concentrated in specific sectors and regions.

Simultaneously, the Global North has experienced an unprecedented concentration of infrastructure investment. According to the World Bank Infrastructure Monitor 2024, 73% of all global infrastructure investment in 2023 occurred in OECD countries, compared with 61% in 2019 (*World Bank, 2025*). This process of investment renationalization reflects a fundamental shift in the logic of global capital allocation. Drivers of this concentration include both economic and geopolitical factors. Large-scale infrastructure modernization programs in the United States, the European Union, and other developed economies generate significant demand for capital. At the same time, policies of nearshoring and friendshoring redirect investment toward politically aligned jurisdictions. Estimates indicate that approximately \$340 billion in infrastructure investment was redirected away from the Global South toward advanced economies between 2020 and 2023 (*Geopolitical Monitor, 2025; World Bank, 2025*).

Technological factors reinforce this concentration. Investment in next-generation infrastructure, such as 5G networks, quantum communications, green hydrogen, and advanced energy storage systems, is increasingly concentrated in economies with strong innovation ecosystems. The Monitor reports that eighty-nine percent of global investment in next-generation digital infrastructure is concentrated in the fifteen most advanced economies (*Geopolitical Monitor, 2025; World Bank, 2025*), posing the risk of a widening technological divide that may further marginalize developing countries. Financial innovations also contribute to this concentration. Green bonds, infrastructure funds, and related instruments are predominantly issued in the deep capital markets of advanced economies. In 2023, eighty-two percent of green bond issuances for infrastructure projects originated in OECD member states. Even when financing is intended for developing economies, the structuring of instruments takes place through financial centers such as London, New York and Tokyo, maintaining the control of developed economies over global capital flows.

Institutional investors are adjusting their strategies to the emerging environment. Pension funds and insurance companies, which traditionally sought diversification through investments in emerging markets, are increasingly shifting their capital toward safer jurisdictions. For example, the Canadian Pension Plan Investment Board reduced its exposure to developing countries from 35% to 18% between 2020 and 2023. The integration of ESG criteria has become a decisive factor in investment decisions. According to the Infrastructure Monitor 2024, 67% of institutional investors consider ESG indicators critically important, compared with 31% in 2019 (*Turner, C., 2021*). Climate-related considerations dominate. Net-zero commitments made by investors controlling more than \$70 trillion in assets effectively exclude carbon-intensive projects from their investment portfolios. The Monitor documents a 78 percent decline in investment in coal-related infrastructure and a 45 percent decrease in financing for gas projects. Although investment in renewable energy has increased by 156 percent, 84 percent of this growth is concentrated in developed economies with stable regulatory environments and subsidized frameworks.

Social requirements add further complexity. Obligations related to community consultations, resettlement, gender equality, and labor standards raise both the cost and duration of project implementation. The average preparation time for an infrastructure project that meets international social standards has increased from 3.2 to 5.7 years (*Geopolitical Monitor, 2025; World Bank, 2025*). Ironically, countries with the most urgent infrastructure needs often have the weakest capacity to meet complex ESG requirements. Localization has emerged as a strategic imperative in a fragmented

environment. Requirements for local content vary widely, ranging from 30% in Brazil to 70% in Nigeria. These requirements significantly alter project economics. Projects with high localization requirements exhibit 23% higher capital costs and face implementation delays of up to 18 months. At the same time, localization fosters long-term benefits through the development of domestic supply chains and technology transfer (*Geopolitical Monitor*, 2025; *World Bank*, 2025).

Technological localization now extends far beyond the domestic production of components. The Chinese model of infrastructure plus technology transfer, which includes the establishment of local R&D centers and specialized training programs, increasingly competes with the Western model of infrastructure plus governance, which emphasizes institutional capacity building. Recipient countries increasingly demand not only physical infrastructure but also technological competencies necessary for its maintenance and further development. Finally, ESG arbitrage has emerged as an unintended consequence of regulatory divergence. Projects rejected by Western investors on ESG grounds increasingly receive funding from alternative sources. The Monitor documents more than 200 such projects, with a combined value of \$45 billion US dollars, financed by Chinese, Middle Eastern, or Russian institutions. This dynamic contributes to the formation of parallel investment ecosystems with distinct standards and operational logics (*Geopolitical Monitor*, 2025; *World Bank*, 2025).

Despite the growing body of research on geo-economic fragmentation and its implications for global development, the dynamics of infrastructural decoupling remain insufficiently conceptualized. Existing studies rarely address how fragmentation reshapes the strategic behavior of states in global infrastructure systems, how investment renationalization alters the geography of connectivity, and how geo-economic competition transforms the institutional architecture governing cross-border flows. This study seeks to fill this gap by examining the mechanisms through which fragmentation reconfigures global infrastructure and by clarifying the geo-economic logic that drives states to pursue decoupled infrastructural strategies.

The purpose of the article is to investigate how infrastructural decoupling unfolds under conditions of accelerating global fragmentation, to identify the economic and political mechanisms behind investment renationalization, and to examine how these processes contribute to the rise of geo-economic competition in key strategic sectors.

Literature review. Research on global infrastructure under conditions of fragmentation emerges at the intersection of institutional, geo-economic, and technological approaches. Analytical reports from international organizations highlight a large-scale reconfiguration of investment flows, logistics networks, and financing mechanisms, emphasizing the systemic nature of current infrastructural transformations (*World Bank*, 2025). Studies addressing the restructuring of the world economic order highlight the relationship between global fragmentation, the rise of regional blocks, and the emergence of new models of infrastructural interaction, which influence investment priorities, risk profiles, and the accessibility of capital (Reznikova & Panchenko, 2023). Work examining economic conflicts and the uneven distribution of interests in the global economy provides a theoretical foundation for interpreting infrastructural competition in a multipolar environment (Reznikova, 2013). Methodological developments in evaluating economic dependence and asymmetry between states help explain investment renationalization as a form of structural reconfiguration of global infrastructural systems (Reznikova, 2012). At the same time, research on the macroeconomic effects of the energy transition highlights the growing role of circular development models and the impact of decarbonization on the logic of infrastructure investment (Reznikova & Grod, 2024).

Monographic studies on the modification of the economic dependence paradigm emphasize that the transition toward a synergistic model of global development is accompanied by the emergence of new forms of infrastructural interaction and competition for control over critical assets (Reznikova & Grydasova, 2024). Regional analyses of infrastructural transformation in specific spatial environments show how fragmentation and mosaic integration shape new configurations of connectivity, influencing logistics, investment, and techno-economic models (Reznikova, Panchenko & Vitchenko, 2025). Concepts of regionalism and institutional cooperation underscore that infrastructural systems have become essential instruments of regional integration, while also

reflecting tensions between cooperation and competition (Knecht, 2013). Research on the governability of regional processes highlights the institutional paradox in which infrastructure develops more rapidly than the regulatory mechanisms required to ensure its sustainability (Luszczuk *et al.*, 2022).

Comparative studies of maritime routes and transport corridors reveal that the fragmentation of global infrastructure is influenced by both technological capabilities and political-economic considerations, which drive the creation of alternative routes and intensify competition among them (Ostreng *et al.*, 2013). Geoeconomic analyses highlight the increasing strategic competition for control over energy and logistics routes, which directly impacts the infrastructural decisions of states (Geopolitical Monitor, 2025; World Bank Group, 2022; ESCAP).

Studies of megaprojects and their transformative impact on global development emphasize that large-scale infrastructural initiatives act as catalysts of structural change but remain highly vulnerable to geopolitical risks and financial shocks (Dimitriou & Field, 2019). Research on the determinants of project success highlights institutional, psychological, and technical factors that shape the performance of large-scale infrastructure, particularly under conditions of heightened geopolitical uncertainty (Flyvbjerg & Gardner, 2023). Documents of international development banks underline the ongoing reorientation of investment flows and the strategic importance of state-driven financing mechanisms for critical infrastructure (AIIB). Analyses of the political economy of regional infrastructure systems explain how global fragmentation stimulates the emergence of alternative infrastructural clusters, new investment alliances, and competitive regulatory regimes (Turner, 2021).

Main results of the research. Infrastructure decoupling is the process of deliberate or forced separation of interdependencies within global infrastructure systems, resulting in the emergence of parallel technological, energy or logistics networks. Unlike classical economic decoupling, which refers to the separation of supply chains, infrastructure decoupling reflects a structural fragmentation of the very architecture of global interaction, including its physical, digital and regulatory channels of connectivity.

Table 1

Classification of Infrastructural Decoupling Types

Type of decoupling	Characteristic	Example or mechanism	Economic consequences
Radical (structural)	Complete separation of infrastructural systems between blocks with autonomous networks, standards, and protocols	Splinternet, parallel 5G systems (Huawei and OpenRAN)	Loss of scale effects, rising costs, and formation of new blocs of global power
Sectoral	Selective disconnection in specific sectors such as energy, digital technologies, or finance	European discontinuation of Russian energy imports, export controls on microchips	Temporary decline in trade, redirection of flows, acceleration of innovation
Temporary (sanctions-induced)	Short-term blocking of access or investment due to political decisions	SWIFT restrictions, sanctions on ports or energy projects	Market destabilization with potential recovery after restrictions are lifted
Institutional	Divergence in regulatory standards and financing rules	Differences among AIIB, World Bank, and EIB frameworks, heterogeneous ESG requirements	Reduced system compatibility, competition among institutional models
Technological	Incompatibility of technical standards, protocols, and data architectures	Separated telecommunications systems, cyber sovereignty, proprietary cloud architectures	Higher transaction costs, erosion of global network effects

Source: Author's elaboration

The key mechanisms of infrastructure decoupling (see Table 1) include: (1) geopolitical rivalry that redirects energy and transport flows; (2) sanctions policy and technological restrictions, for example, in semiconductors or 5G systems; (3) institutional asymmetry between alternative infrastructure initiatives such as the BRI, the PGII, and the Global Gateway. The concept materializes in the infrastructure sector through the formation of parallel and often incompatible logistics networks. The World Bank Infrastructure Monitor 2024 documents an unprecedented reconfiguration of global supply chains, where geopolitical considerations increasingly outweigh economic efficiency. The cost of such duplication, estimated at around \$ 180 billion for digital infrastructure alone, represents a significant burden on the global economy, but also contributes to resilience through diversification. Paradoxically, infrastructure decoupling not only increases transaction costs but also creates new forms of systemic resilience, as diversified networks make the global economy less vulnerable to monopolization.

Technological decoupling is most visibly manifested in the domain of digital infrastructure. The phenomenon of the splinternet, or the fragmentation of the once unified internet into regional networks with different standards and rules, is becoming a practical reality. The Monitor indicates that forty-three countries have introduced or plan to introduce data localization requirements, which creates the need to duplicate data centers and network infrastructure. The cost of such duplication is estimated to be \$ 180 billion by 2030. The divergence between 5G ecosystems (Huawei versus Ericsson, Nokia, and Samsung) means that countries are effectively choosing a technological trajectory for decades ahead (*Geopolitical Monitor*, 2025; *World Bank*, 2025).

Energy supply chains are experiencing the most profound transformation since the oil crisis of the 1970s. Sanction regimes, energy security imperatives, and climate objectives are generating a mosaic of parallel energy systems. The Monitor identifies at least three major energy clusters: the transatlantic cluster (comprising the United States and the European Union, with a focus on LNG and renewable energy), the Eurasian cluster (dominated by pipeline gas and coal), and the Middle Eastern cluster (OPEC Plus, with its traditional focus on oil). Infrastructure adapts to this fragmentation through the construction of new LNG terminals, the reorientation of pipeline flows, and the establishment of regional energy hubs (*Geopolitical Monitor*, 2025).

The transatlantic cluster is formed around energy cooperation among the United States, Canada, and the European Union, with a focus on diversifying supply and decarbonization. Its core characteristics include the rapid expansion of infrastructure for liquefied natural gas, the development of offshore wind power, hydrogen logistics, and energy storage systems. The cluster combines energy security with climate objectives, creating an institutionally coordinated space of green Trans- Atlanticism in which ESG standards and technological compatibility function as instruments of political cohesion. The Eurasian cluster, in the context of mosaic integration of the Arctic, represents a polycentric zone of infrastructural activity shaped by state-guided large-scale energy, transport, and logistics projects that ensure connectivity across the continental spaces of the North. Its distinctive feature is the dominance of vertically integrated institutional structures, industrial chains, and transcontinental corridors that link the European and Asian components of the world economy. Within the mosaic architecture of the Arctic, the Eurasian cluster embodies the logic of managed scale, where infrastructure is used as a tool for stabilizing vast territories and shaping strategic interdependence between states and markets. Consequently, the Eurasian cluster encompasses continental energy systems based on pipeline gas, coal, and nuclear energy. Its logic relies on centralized resource management, vertically integrated companies, and strategic planning of trunk infrastructure. The primary objective is to preserve energy sovereignty through control of resource flows and transit corridors. The Middle Eastern cluster (*OPEC Plus*) maintains its traditional dominance in oil markets, while gradually diversifying its energy structure by investing in gas, hydrogen, and solar infrastructure. Its main characteristic is institutional coordination of production and pricing through multilateral mechanisms that balance market stability with exporter revenues. In the mosaic logic of global energy, this cluster represents energy pragmatism, combining supply control with technological adaptation to the requirements of the green transition.

Transport corridors are being reconfigured according to new geopolitical realities. The Middle Corridor, spanning the Caspian Sea and the Caucasus, which bypasses Russia, has attracted over \$ 10 billion in investments as an alternative to the traditional northern route. The International North South Transport Corridor through Iran creates a new Russia-India axis. The Belt and Road Initiative is adapting by developing southern routes through Pakistan (CPEC) and Myanmar. This multiplicity creates redundancy and inefficiency, as the duplication of logistical infrastructure increases global transport costs by 8 to 12 percent (*Geopolitical Monitor*, 2025; *World Bank*, 2025). Production chains are fragmenting due to reshoring and friendshoring policies. Semiconductor supply chains are splitting between an America-centered ecosystem (supported by the CHIPS Act with \$52 billion in subsidies) and China's strategy of technological self-sufficiency (with more than \$150 billion *invested in local manufacturing*). Europe is attempting to form a third pole through the European Chips Act, with forty-three billion euros (*Geopolitical Monitor*, 2025; *World Bank*, 2025). This triad results in the tripling of global investment in semiconductor infrastructure but also creates incompatible standards and technologies. Financial infrastructure is adapting to fragmentation through the creation of alternative payment systems. SWIFT, which has long dominated international settlements, is now facing competition from China's CIPS, India's UPI, and cryptocurrency-based payment bridges for international transactions. The Monitor indicates that the share of SWIFT in global payments declined from 98% to 87% between 2020 and 2023. This shift requires investment in parallel clearing systems, correspondent banking networks, and regulatory infrastructure.

Fragmentation is fundamentally transforming not only the geography of investment and the architecture of supply chains but also the very concept of infrastructure development. The World

Bank Infrastructure Monitor 2024 (*World Bank, 2025*) documents the transition from universal models based on the principles of the Washington Consensus to a pluralistic system with competing development paradigms. The model of «infrastructure as a service» is emerging as a response to financial constraints and technological complexity. Instead of the traditional build-and-transfer approach, new models rely on the long-term management of infrastructure assets by specialized providers. Digital Colony, with assets exceeding \$25 billion, focuses on managing digital infrastructure ranging from data centers to mobile network towers. Similar models are expanding in the energy sector through virtual power plants, in transportation, and in water systems through water-as-a-service. This shift transforms infrastructure from a capital-intensive asset into an operational service (see Table 2).

Table 2

Shifts in Infrastructure Delivery Models amid Global Economic Fragmentation

Model	Key characteristic	Application field	Economic effect	Analytical significance
<i>Infrastructure as a service</i>	Transition from asset ownership to service-based management; monetization of infrastructure through operational contracts.	Digital, energy, transport	Reduced capital expenditure; increased efficiency of asset use.	Reflects the shift to a service-based infrastructure economy.
<i>Modular infrastructure</i>	Decentralized and scalable architecture capable of rapid adaptation.	Energy, logistics, IT	Thirty-five percent lower risk of stranded assets; forty percent higher flexibility.	Indicates the transition to adaptive and flexible systems.
<i>Hybrid ownership models</i>	A combination of private management and public control through golden share mechanisms and concessions.	Critical infrastructure (energy, transport)	Balance between efficiency and sovereignty; preservation of control over strategic assets.	Represents a new form of public-private interaction.
<i>Resilient infrastructure</i>	Design, based on risk awareness and resistance to climate, cyber, and geopolitical shocks.	All infrastructure sectors	+15 to 20 percent capital costs but minus 40 to 60 percent operational losses.	Shifts project evaluation logic from cost minimization to life cycle optimization.
Ecosystem model	Integration of different infrastructures into a coordinated environment (smart cities, eco-industrial parks).	Urban governance, logistics, industry	Synergy generates an additional 25 to 40 percent of added value.	Reflects the shift from isolated projects to networked ecosystems.

Source: Author's elaboration

Modular infrastructure is becoming a strategic response to uncertainty and rapid transformation. Instead of large-scale centralized systems, new projects prioritize distributed and scalable solutions. Microgrids are increasingly replacing large power plants, while distributed data centers are reducing dependence on single hubs. Modular ports also allow for rapid adaptation to changing trade flows. The Monitor shows that projects with modular architecture have a 35 percent lower risk of stranded assets and 40 percent higher adaptability to demand fluctuations (*World Bank, 2025*).

Infrastructure diplomacy views infrastructure as an instrument of cooperation and partnership. Through bilateral and multilateral agreements, joint financing, and technical assistance, states strengthen trust and develop soft power. This form of interaction is hybrid, as it combines elements of cooperation and competition, forming infrastructure alliances that support sustainable development. In contrast, infrastructure geopolitics reflects a competitive logic in which infrastructure becomes a tool of geoeconomic influence. Major powers such as the United States, China, the EU, and India use transport corridors, energy systems, and digital networks as levers of strategic control over space and resources. This model contributes to the fragmentation of the global economic landscape and the formation of alternative infrastructural blocs. Depending on the scale and actors involved, three types of infrastructure projects can be distinguished (Table 3).

Table 3

Forms of Infrastructure Cooperation			
Criterion	Infrastructure Project	Infrastructure Megaproject	Global Infrastructure Project
Scale	Local or regional	National or interregional	Transnational or global
Level of impact	Technical, operational	Institutional, political	Geopolitical, civilizational
Governance model	Technocratic	Adaptive strategic	Geoinstitutional, network-based
Function	Provision of basic services	Structural transformation	Formation of global flows and dependencies
Actors	State agencies, contractors	Government, business, communities, MDBs	International coalitions, supranational institutions
Duration	3–10 years	10–30 years	20–50 years or more

Source: Author's elaboration

Infrastructure alliances constitute a new system of international governance in which cooperation is carried out through network-based mechanisms. They integrate political, technological, social, and economic dimensions, creating shared infrastructure spaces that operate as environments for collective action. In other words, an infrastructure alliance is a form of cooperative partnership in which states, private companies, and international organizations coordinate joint infrastructure initiatives through the use of harmonized standards, digital platforms, and financial instruments.

Unlike traditional models of international cooperation, infrastructure alliances operate not as supranational structures but as collaborative networks based on data exchange and principles of mutual trust. According to the definition (*World Bank Group, 2022*), such alliances form a global ecosystem of interconnected initiatives within which technological, financial, and institutional flows become mutually dependent.

Infrastructure investment has become a central element of the global financial architecture of the twenty-first century, combining the long-term character of capital, the socio-economic function of development, and the political significance embedded in the system of international

relations. Unlike traditional financial assets, infrastructure represents the material foundation of productivity, enabling the mobility of resources, the connectivity of markets, and the resilience of societal systems. Infrastructure investment constitutes a distinct asset class characterized by stable cash flows, low correlation with other markets, and high social value. At the same time, it is one of the most complex segments in terms of valuation, risk management, and long-term return. Consequently, infrastructure investment functions today as a hybrid instrument that is simultaneously financial and social, private and public, market-oriented and strategic. Its development requires a balance between economic efficiency and societal benefit, making this form of capital unique within the contemporary political economic system.

Conclusions. This study provides evidence that infrastructural decoupling has become a structural determinant of the emerging geoeconomic order, marking a transition from the universal connectivity model of hyperglobalisation to a selective, strategically filtered connectivity regime. The findings show that fragmentation does not simply reduce global interdependence but reorganizes it into differentiated infrastructural spheres, where political alignment, technological compatibility, and institutional reliability increasingly outweigh considerations of cost and efficiency. This represents a fundamental shift in the operational logic of global infrastructure.

The research confirms that the renationalization of investment and the redirection of private capital from the Global South toward advanced economies constitute a long-term systemic reconfiguration rather than a temporary reaction to uncertainty. This realignment reshapes global development trajectories by reinforcing asymmetries in access to finance, technology, and innovation capacity. The concentration of infrastructure investment in OECD economies, combined with the rising cost of capital in developing regions, establishes a new hierarchy of infrastructural opportunities and constraints.

A key contribution of this study lies in identifying the mechanisms through which fragmentation materializes in infrastructure systems. The analysis demonstrates that infrastructural decoupling unfolds simultaneously at the technological, financial, regulatory, and spatial levels. Technological divergence leads to the development of parallel digital ecosystems and incompatible data architectures. Financial fragmentation gives rise to alternative payment networks and competing capital pools. Regulatory divergence multiplies non-aligned standards and ESG regimes. Spatial reconfiguration manifests in competing transport corridors and plural energy clusters. Together, these mechanisms constitute a multilayered architecture of decoupling.

The study advances the conceptual understanding of global infrastructure by demonstrating that infrastructure alliances, modular and service-based infrastructure models, and resilience-oriented design principles emerge as adaptive institutional responses to the fragmentation of infrastructure. These instruments do not replace multilateralism but reshape it into network-based governance, where coordination occurs through flexible coalitions rather than universal rules. This represents a significant evolution in global infrastructure governance.

The analysis reveals that fragmentation redefines the strategic behavior of states: infrastructure becomes a tool of geoeconomic competition and a means for redistributing influence across global flows. States increasingly use corridors, energy systems, digital platforms, and financing tools to shape the geography of dependence and autonomy. As a result, the global infrastructure landscape evolves into a mosaic of overlapping clusters and selective partnerships rather than a single integrated system. The analysis demonstrates that infrastructural decoupling is not a uniform phenomenon but a multidimensional process that unfolds across structural, sectoral, sanctions-driven, institutional, and technological levels. The typology introduced in this study enables the conceptualization of distinct forms through which global infrastructure becomes fragmented and the identification of mechanisms that generate these disconnections. The structural dimension reflects the emergence of autonomous infrastructural ecosystems across competing blocs, the sectoral dimension captures decoupling within critical industries, the institutional dimension emerges through the divergence of regulatory standards and financing models, the sanctions-driven dimension has a temporary and politically induced character, while the technological dimension produces long-term trajectories of incompatibility across digital, energy, and logistics systems. This typology provides a conceptual lens for understanding why

infrastructural decoupling has become a defining feature of the new geoeconomic configuration and how different forms of fragmentation jointly reshape investment patterns, connectivity corridors, and the dynamics of global competition.

Overall, the study concludes that infrastructural decoupling is a long-term structural trajectory that will continue to reshape global development patterns. In an environment where universal integration is no longer the baseline, the capacity of states and alliances to design adaptive, resilient, and strategically aligned infrastructural systems will determine their position in the future geoeconomic landscape. Understanding these dynamics is crucial for anticipating systemic risks, allocating investment resources effectively, and shaping policies that strike a balance between efficiency and sovereignty in an increasingly complex global order.

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