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FROM FRAGMENTATION TO MOSAIC INTEGRATION: THE INFRASTRUCTURE ECONOMY OF THE ARCTIC IN THE CONTEXT OF POST-UNIVERSALIST GLOBALIZATION

The article conceptualizes the Arctic as a mosaic infrastructural region where connectivity emerges not from political borders but from interoperable networks across transport, energy, digital and environmental domains. Building on infrastructural regionalism and the notion of infrastructural imaginaries, the paper argues that Arctic governability depends on protocol-level compatibility among heterogeneous subsystems rather than on centralized institutions. In this view, corridors, undersea cables, satellite constellations, sensors and floating foundations do not merely support economic activity but actively shape the region's boundaries and logic. We map three polycentric clusters - Eurasian, Nordic, and North American - each embodying distinct infrastructural imaginaries and governance modalities: the Eurasian cluster emphasises state-led mega-projects in energy and logistics; the Nordic cluster promotes green infrastructural partnerships and community-based resilience; the North American cluster foregrounds innovation, entrepreneurial public-private initiatives and Indigenous autonomy. The article further examines the co-evolution of digital and energy systems in the Far North, showing how modular data platforms and hybrid power systems reinforce each other to form an "Arctic infrastructure of knowledge." It explores resilience mechanisms under rapid warming and permafrost degradation, demonstrating how adaptive engineering (e.g., thermosiphons, floating foundations) and predictive analytics alter the risk calculus of polar development. The study proposes a policy toolkit for managed interdependence: standards alignment, interoperable data-sharing architectures, adaptive engineering, co-governance with Indigenous communities and green conditionality for capital flows. By reframing infrastructure not as passive support but as active region-maker, the article positions the Arctic as a laboratory for a post-universalist model of globalization-connectivity without uniformity, where regionality is produced through protocols, networks and negotiated sovereignty.

Key words: sustainable development, inclusive model, coopetition, cooperation, fragmentation, polarization, standardization, infrastructure, project, sustainability, resilience, transatlaticism, Arctic, infrastructure economy, integration, interoperability, logistics corridors, energy transition, digital connectivity, resilience, environmental governance, infrastructure diplomacy, private-public initiatives, North America, Asia, Europe, economic interest

JEL Classification: D33, D72, E25, E65, O15

ВІД ФРАГМЕНТАЦІЇ ДО МОЗАІЧНОЇ ІНТЕГРАЦІЇ: ІНФРАСТРУКТУРНА ЕКОНОМІКА АРКТИКИ В УМОВАХ ПОСТУНІВЕРСАЛІСТСЬКОЇ ГЛОБАЛІЗАЦІЇ

Метою дослідження є аналіз Арктики як простору інфраструктурної регіоналізації та визначення ролі коопетиції, сталого розвитку й інклюзії у формуванні моделей керованої фрагментації. Завданнями передбачено: розкрити логіку мозаїчної інтеграції; показати механізми коопетиційної взаємодії між акторами; виявити принципи інфраструктурної дипломатії; проаналізувати вплив екологічних і соціальних чинників на формування арктичного режиму управління. В статті використано міждисциплінарний підхід, що поєднує просторовий аналіз, інституційну теорію, політичну географію й екологічну економіку. Методологічним інструментом виступає інтерпретація інфраструктури як операційної системи простору - сукупності матеріальних і нормативних платформ, через які здійснюється зв'язність і управління у багаторівневих системах. У статті Арктика розглядається як мозаїчний інфраструктурний регіон, де зв'язок виникає не з політичних кордонів, а з сумісних мереж у транспортній, енергетичній, цифровій та екологічній сферах. Спираючись на інфраструктурний регіоналізм та поняття інфраструктурних уявлень, у статті стверджується, що керованість Арктикою залежить від сумісності на рівні протоколів між гетерогенними підсистемами, а не від централізованих інституцій. З цієї точки зору, інфраструктура формує межі та логіку регіону. Встановлено, що поліцентричні кластери втілюють різні інфраструктурні уявлення та способи управління: виокремлюємо мегапроекти в енергетиці та логістиці; кластер, що розвиває зелені інфраструктурні партнерства; кластер, що абсолютизує інновації, підприємницькі державно-приватні ініціативи та автономію корінних народів. У статті розглянуто коєволюцію цифрових та енергетичних систем, показуючи, як модульні платформи даних та гібридні енергетичні системи підсилюють одна одну, формуючи «арктичну інфраструктуру знань». В статті досліджено механізми стійкості до швидкого потепління, демонструючи, як адаптивна інженерія та прогнозна аналітика змінюють розрахунки ризиків полярного розвитку. У дослідженні пропонується набір інструментів політики для керованої взаємозалежності: узгодження стандартів, сумісні архітектури обміну даними, адаптивна інженерія, «зелена» обумовленість для потоків капіталу. Переосмислюючи інфраструктуру не як пасивну підтримку, а як активного регіоноутворювача, стаття позиціонує Арктику як лабораторію для постуніверсалістської моделі глобалізації, що передбачає зв'язок без однорідності, де регіональність продукується через протоколи, мережі та узгоджений суверенітет.

Ключові слова: сталий розвиток, інклюзивна модель, коопетиція, конкуперация, фрагментація, поляризація, стандартизація, інфраструктура, проєкт, сталість, резильєнтність, трансатлантизм, Арктика, інфраструктурна економіка, інтеграція, кластер, логістичні коридори, енергетичний перехід, цифрова зв'язність, резильєнтність, державно-приватне партнерство, екологічне урядування, інфраструктурна дипломатія, Північна Америка, Азія, Європа, економічний інтерес

Introduction. The modern era of fragmentation of the world space creates new modes of interaction in which the Arctic appears not as a periphery, but as a testing ground for future global infrastructure. Climate change, technological innovation and shifts in geopolitical architecture stimulate the emergence of models of managed interdependence, where integration occurs not through political unification, but through the coherence of technical standards. The Arctic is a unique environment for studying such processes, because it is here that routes between Europe, North America and Asia intersect, as well as the interests of states, corporations, scientific institutions and indigenous peoples. Its development requires a new type of thinking – infrastructural, in which space is understood as a network of interacting systems.

For the Arctic region, the modern logic of mosaic integration, that is, a type of spatial interaction that involves the coexistence of multiple, partially compatible infrastructure networks and regulatory systems is of particular importance.

Unlike classical globalization, which was based on unified standards for trade, finance, and logistics, mosaic integration forms a new architecture of interconnected but

autonomous regional clusters, where each subsystem develops in its own political, technological, and financial environment. In the face of increasing fragmentation, such a model allows for the preservation of global connections through the partial interaction of infrastructure platforms - transport, energy, digital, and environmental. That is why the Arctic, where routes between Europe, North America, and Asia intersect, becomes a natural space for the formation of a mosaic infrastructure system that combines the interests of different megaregions of the world.

In this study, mosaic integration is considered as a type of spatial and economic interaction based not on institutional unification, but on the partial compatibility of heterogeneous systems - transport, energy, digital, environmental. It involves the coexistence of autonomous infrastructure and regulatory subsystems that interact through common protocols, technical standards and data architectures, ensuring managed interdependence within a fragmented global space.

Mosaic cooperation in this context is defined as a flexible form of interaction that combines elements of competition, partnership and interoperability. It allows states, corporations, scientific institutions and local communities to

coordinate actions in selected functional areas without the need for political or institutional convergence. Such a model creates the prerequisites for a post-universalist type of globalization, in which connectivity is maintained without homogeneity.

Concoopetition represents a specific form of collaboration in which actors simultaneously compete and cooperate within shared infrastructural or technological platforms. It ensures a dynamic balance between innovative rivalry and the joint creation of added value. Unlike classical cooperation, concoopetition does not eliminate the conflict of interests but transforms it into a constructive driver that enhances efficiency, resilience, and adaptability of systems. Within the mosaic economy of the Arctic, concoopetition functions as a mechanism for balancing the pursuit of autonomy with the necessity of interoperability, fostering network trust and mutual learning among actors of different scales. The infrastructure economy, in turn, means a system of production, distribution and management in which infrastructure networks - transport, energy, digital and environmental - become the main environment for the formation of value, regionality and interdependence. Space in this paradigm functions as an operating system, where material and normative platforms ensure the circulation of resources, data and capital. Thus, the infrastructure economy is defined not so much by industry or financial indicators, but by the level of interoperability between technical and institutional systems, which creates the basis for the mosaic integration of the Arctic as a laboratory of managed interdependence.

Literature review. The academic understanding of the Arctic as a region of integration has shifted from perceiving it as a remote geopolitical periphery to interpreting it as a dynamic space of infrastructural and institutional connectivity. Researchers increasingly conceptualize the Arctic as a laboratory for new regional orders built on interoperability rather than uniformity. M. Łuszczuk [11] and co-authors demonstrate that the European Arctic functions as a complex *governability* system, where cross-border cooperation frameworks-such as the Barents Cooperation and the Northern Periphery and Arctic Programme-generate stability through institutional coordination rather than political integration. Their analysis confirms that fragmented regional architectures can achieve coherence through shared governance mechanisms. S. Knecht [10] introduces the notion of Arctic regionalism “from cooperation to integration,” arguing that gradual harmonization of norms, practices, and trust-based diplomacy can transform scattered partnerships into sustainable integration. He asserts that functional regionalism, rather than sovereignty-driven politics, defines the future of the Arctic. The editors of the *Arctic Yearbook* [17] emphasize that the Arctic represents a prototype of network governance, where collaboration arises through flexible institutional linkages instead of centralized hierarchies. This perspective reframes integration as a process of coordination among heterogeneous actors and infrastructures. O. Young [18] establishes that the Arctic’s governance evolution follows functional pathways-shipping, environmental protection, and safety regimes-rather than geopolitical alignment. His theory of overlapping

regimes shows that practical integration occurs through the interoperability of international norms under the UNCLOS framework. The *Arctic Marine Shipping Assessment* [2] validates this model empirically by mapping navigation routes, infrastructure gaps, and environmental risks. It demonstrates that coordinated maritime standards are essential for a secure and sustainable Arctic transport system. The *Polar Code* adopted by the International Maritime Organization [9] consolidates these practices into a unified regulatory structure, proving that shared safety and environmental requirements serve as a foundation for technical integration and trust among Arctic stakeholders. The *Agreement on Enhancing International Arctic Scientific Cooperation* [3] provides a legally binding framework for transnational research collaboration. It confirms that the free flow of scientific data, logistics, and knowledge production has become a new infrastructure of regional integration. The European Union’s *Joint Communication on the Arctic* [7] formalizes a comprehensive vision for Arctic engagement, positioning the region within the European Green Deal and emphasizing the alignment of environmental, digital, and investment standards as mechanisms of integration. China’s *White Paper on Arctic Policy* [16] conceptualizes the *Polar Silk Road* as an extension of the Belt and Road Initiative, promoting shared development of infrastructure, science, and trade under a multilateral model of “win-win regionalism.” Finally, the Barents Cooperation [8] demonstrates the resilience of multilevel governance in the Arctic. Through the Barents Euro-Arctic Council and the Barents Regional Council, it maintains regional coherence by integrating state, regional, and Indigenous actors in a single institutional framework of collaboration. Together, these studies confirm that the Arctic has evolved into a region of managed interdependence, where interoperability of standards, infrastructures, and knowledge systems replaces classical notions of political or economic integration.

Despite the growing body of research that highlights the role of political and institutional design in shaping regional development, the Arctic remains conceptually underdefined as a space where governance, technology, and ecology converge into a single infrastructural logic. Existing studies tend to describe cooperation or competition among Arctic states, yet they rarely capture how material infrastructures-ice-class ports, energy corridors, digital constellations, and environmental regimes-function as the actual mechanisms of integration and differentiation. Building on this gap, our approach shifts the analytical focus from political institutions to infrastructural architectures as the operational foundations of regional order. We therefore propose a methodological framework that classifies Arctic subsystems by their degree of interoperability, resilience, and inclusiveness, positioning them within a spectrum of managed interdependence. This enables us to trace how the interplay of governance norms, technological protocols, and ecological imperatives produces distinct configurations of integration across the Arctic mosaic.

The purpose of the study is to analyze the Arctic as a space of infrastructural regionalization and determine the role of coopetition, sustainable development and inclusion

in the formation of models of managed fragmentation. The tasks are: to reveal the logic of mosaic integration; to show the mechanisms of coepetitional interaction between actors; to identify the principles of infrastructure diplomacy; to analyze the influence of environmental and social factors on the formation of the Arctic governance regime. The article uses an interdisciplinary approach that combines spatial analysis, institutional theory, political geography and ecological economics. The methodological tool is the interpretation of infrastructure as an operating system of space – a set of material and normative platforms through which connectivity and management in multi-level systems are carried out.

Main results of the research. The Arctic is increasingly understood not only as a geographical or resource space, but as a space of infrastructural imaginary – that is, the way in which states, corporations and societies imagine and legitimize their own presence in global networks. According to the definition of M. R. Glass, J.-P. D. Addie & J. Nelles [8], infrastructure is not just a material framework, but an “operational system of space” that creates new types of regionality. For the Arctic, this means that it is the infrastructure that defines the boundaries of the region: ports, icebreakers, cable systems, satellite platforms and environmental regulations form a topology of interconnections in which political borders lose their defining role. Thus, the Arctic is a space of infrastructural regionalism – that is, a region that does not precede infrastructure, but is created by it. This is a fundamental difference from the classical models of regionalism, which were based on territorial commonality. Infrastructure here does not imitate geography, but constructs it, creating a polycentric system of connections in which national, corporate and supranational interests can coexist.

Arctic projects in this system act as elements of an integrated but structurally segmented network, including maritime transport routes, energy corridors, digital communication routes and ecological control zones. Each of these areas has its own standards, financing models and management mechanisms, which creates a unique multi-level system of interdependence. It is the level of technical and institutional compatibility between these subsystems that will determine the potential of the Arctic as a space of managed interdependence in a fragmented world. High coherence of security standards, digital protocols and environmental norms can transform the region into a model of balanced cooperation between megaregions, while inconsistency and competition of norms, on the contrary, will increase the risks of isolation and economic instability.

The Transatlantic cluster centers on energy interaction between the United States, Canada, and the European Union, oriented toward supply diversification and decarbonization. It is characterized by the rapid deployment of LNG infrastructure, offshore wind power, hydrogen logistics, and energy storage systems. Combining energy security with climate objectives, it forms an institutionally aligned space of the green transatlanticism, where ESG standards and technological compatibility serve as tools of political cohesion. Transatlanticism, in the context of this research, is understood as a system of institutional, economic, and

value-based linkages between North America and Europe, grounded in the coherence of standards, technologies, and governance models. Within the ongoing energy transition, transatlanticism functions as an integrative platform where climate goals are aligned with security interests, and renewable energy, LNG infrastructure, digital networks, and ESG standards serve as mechanisms of political and technological cohesion. In the mosaic architecture of global energy, transatlanticism embodies the logic of normative integration – connectivity based on shared rules, mutual trust, and technological interoperability.

The Middle Eastern cluster (OPEC+) maintains its traditional dominance in oil markets while gradually diversifying into gas, hydrogen, and solar infrastructure. Its defining feature is institutional coordination of production and pricing through multilateral mechanisms that balance market stability with exporters' revenues. Within the mosaic logic of global energy, this cluster embodies energy pragmatism, combining supply control with technological adaptation to the imperatives of the green transition.

The Eurasian cluster encompasses continental energy systems dominated by pipeline gas, coal, and nuclear power. It is structured around state-led resource governance, vertically integrated corporations, and strategic management of trunk infrastructure. Its primary aim is to preserve energy sovereignty through control of resource flows and transit corridors. Within the mosaic architecture of global energy, the Eurasian cluster represents a model of managed scale – stabilizing vast territories through infrastructural control and long-term interstate agreements.

The Arctic increasingly functions as a laboratory for new forms of interdependence where economic security is achieved not through isolation or dominance, but through the management of shared vulnerabilities. Infrastructural interconnectivity-linking transport corridors, digital networks, and energy systems-creates a fabric of mutual reliance that transforms competition into stability [6]. The region's harsh environment and technological challenges require joint standards, cooperative investment, and knowledge exchange, making resilience a collective rather than individual outcome. Economic security in this context emerges from the diversification of supply routes, the redundancy of energy sources, and the transparency of data ecosystems that reduce systemic risks. As global volatility intensifies, the Arctic offers a prototype of managed interdependence: an ecosystem where cooperation ensures continuity, interoperability ensures efficiency, and inclusiveness ensures legitimacy. By aligning environmental stewardship with infrastructural innovation, the Arctic demonstrates that sustainability and security are no longer opposing goals but mutually reinforcing conditions of regional prosperity [12; 13; 14; 15].

The Arctic demonstrates the emergence of a new form of infrastructural regionalism in which space is defined not by political borders but by networks of connectivity. Infrastructures act as operational systems that generate spaces of coexistence despite jurisdictional barriers. In this sense, Arctic regionalization displays a polycentric character composed of three overlapping infrastructural clusters: one centered on state-led control of large-scale energy and

transport systems; another built around Nordic models of “green infrastructural partnership” and community-oriented resilience; and a third shaped by innovation-driven frameworks emphasizing local autonomy and public–private collaboration. Together, these clusters form a dynamic mosaic where infrastructural compatibility, rather than territorial alignment, becomes the principal mechanism of integration and governance.

A mosaic integration is being formed between these centers, where coordination is achieved not through centralized institutions, but through the interaction of infrastructure protocols – energy networks, cable systems, environmental monitoring. Such a polycentric regime creates infrastructure diplomacy – a network of “soft” contacts (scientific exchanges, security standards, joint navigation systems) that maintain connectivity even in periods of political tension. Thus, the Arctic is a laboratory of a new form of global governance – managed fragmentation, where regional integration is based on the compatibility of technological standards, not political alliances. Thus, the Arctic becomes not a peripheral territory, but a nodal field of the global infrastructure mosaic, where new formats of interaction are tested in a world that is increasingly losing unity, but is looking for new mechanisms of connectivity.

The Arctic is increasingly seen not only as a material space for resource development, but also as a symbolic arena for the formation of infrastructural imaginaries—that is, the ways in which societies imagine, project, and legitimize their connections with the planet. In the terms of M. R. Glass, J.-P. D. Addie & J. Nelles [8], infrastructural imaginaries define who and how “sees” the region through the prism of infrastructure. For the Arctic space, such imaginaries have three levels: (1) technocratic (the Arctic as a laboratory for engineering solutions); (2) geopolitical (the Arctic as the stage for a new “great game”); (3) civilizational—the Arctic as a space for coexistence between man and planet. These imaginaries are materialized in maps, strategic documents, and visual models—from the “Polar Silk Road” to the “Smart Arctic” projects. Thus, infrastructure is not just a set of objects, but the language of the political imaginary that shapes the way of thinking about the future of the northern territories.

Today, the struggle for the Arctic is not so much a struggle for resources as for the right to determine the future of infrastructural modernity. The Arctic, long perceived as the periphery of the global economy, is transforming into one of the most dynamic infrastructural frontiers of the 21st century. Climate change, technological innovation, and geopolitical competition are transforming this region into a laboratory for new development models, where extreme conditions stimulate infrastructural innovation, and ecological vulnerability requires an unprecedented level of resilience. An analysis of the transformation of the Arctic allows us to understand how a new paradigm of infrastructural development is being formed in the context of the convergence of economic ambitions, environmental imperatives, and geopolitical interests. The Arctic faces a development paradox: the economic activity necessary for the modernization of the region simultaneously increases environmental risks.

The key issue is the governability of this paradox—the ability of institutions to coordinate the conflicting goals of growth, security, and ecology. In the European Arctic, governance mechanisms are formed through a network of interregional formats—the Barents Regional Cooperation, the Arctic Council, and the Northern Periphery and Arctic (NPA) program. These institutions create a system of multilevel governance, where coordination is achieved not through rigid hierarchies but through horizontal connections between states, regions, academic institutions, and indigenous communities.

The effectiveness of such a regime is determined by the interaction of three elements: (1) the governance system—institutions, rules, and procedures; (2) the system-to-be-governed – the natural, economic, and social environment; (3) governing interactions – the mechanisms through which decisions are made. It is at the intersection of these elements that the search for a balance between economic development and environmental sustainability takes place.

Arctic development can be described as an economy of infrastructure circulation, in which capital is not simply invested in buildings, but is constantly moved between projects, regimes, and technologies. Infrastructure funds from Asia, North America, and Europe are creating joint investment platforms – Arctic Investment Protocol, Blue Arctic Fund – that operate on the principle of “limited partnership” to minimize political risks. In this economy, not only resources circulate, but also knowledge, engineering standards, and digital models. This is how the “Arctic infrastructure knowledge cluster” is formed: Norwegian marine technologies, Canadian eco-engineering solutions, Japanese energy-saving systems, Finnish “smart maintenance” models. The interaction of these systems is transforming the Arctic into an “innovative hub of cold technologies” – not a periphery, but a source of new infrastructural rationality for the global North.

The conceptual transformation of the Arctic – from a “frozen desert” to a “development space” – is taking place under the influence of a complex of factors that are fundamentally changing the economic geography of the region. As M. Bemnnette shows in his work “Development in Crisis”, Arctic infrastructure is gradually turning into a testing ground for technologies capable of functioning in extreme conditions. In the future, such technological solutions can be adapted for other complex environments – from deep-sea mining to space research missions. [5, p. 45-67].

The technological revolution in Arctic construction demonstrates humanity’s ability to adapt infrastructure to the most difficult natural conditions. Thermosyphons for stabilizing permafrost, used on the Trans-Alaska pipeline, have evolved into complex active temperature management systems. The Norwegian company Kværner has developed Arctic Concrete with the addition of microsilica and polymer fibers, which maintains structural integrity at temperatures down to -60°C. The modular architecture, originally developed for Arctic research stations, is now being adapted for rapid deployment of infrastructure in conditions of a short construction season.

The digital transformation of Arctic infrastructure is ahead of many more southern regions due to the need for

remote management and monitoring. The OneWeb and Starlink satellite constellations provide broadband Internet at latitudes where traditional terrestrial infrastructure is not cost-effective. Digital twins of Arctic infrastructure objects – from ports to pipelines – allow for optimized operations and predictive maintenance in conditions of limited physical accessibility. According to estimates by the Arctic Economic Council, the implementation of IoT sensors and predictive analytics reduces the operating costs of Arctic infrastructure by 25-40% [4]. Arctic digital networks are shaping a new type of operating system of regional space. As J.-P.D. Addie et al. [1] argue, digital protocols and standards are becoming the basis for regional interoperability [1]. In Northern Europe and North America, there is a convergence of digital standards for navigation, ice monitoring, and cybersecurity, creating a post-territorial regionality-a space in which technical interoperability is more important than political boundaries.

Energy autonomy is becoming a critical feature of Arctic infrastructure. Hybrid systems combining diesel generators with renewables demonstrate the potential for decarbonization even in the most challenging climates. The Ragnovidda project in Norwegian Lapland, the largest wind farm beyond the Arctic Circle, generates 350 MW despite extreme weather conditions. Flow battery energy storage systems are adapted to Arctic temperatures, ensuring a stable power supply during the polar night.

The logistics revolution in the Arctic is creating new models of transport infrastructure. Ice roads – seasonal roads on frozen bodies of water – are evolving thanks to technologies for strengthening ice and monitoring its thickness in real time. Hovercraft and ekranoplanes are being reborn as solutions for year-round transport in conditions of variable ice cover. Autonomous cargo systems being tested in the Canadian Arctic demonstrate the potential of unmanned logistics for remote communities.

Conclusion. The Arctic has moved from cartographic periphery to an infrastructurally produced region in which ports, icebreakers, cable systems, satellite constellations, energy corridors and environmental regimes collectively define space; not political borders but protocol-level interoperability across transport, energy, digital and

ecological platforms now organizes the territory's polycentric order, with Eurasian state-led corridors, Nordic green partnerships and North American innovation systems held together by an infrastructural diplomacy of shared standards and data flows that sustains connectivity amid geopolitical tension. In this setting, development operates as an economy of infrastructural circulation: capital, technologies and norms migrate across projects and regimes, creating new value chains in logistics, hydrocarbons and critical minerals, fisheries, tourism and digital services, while co-opetition-simultaneous competition and cooperation-structures incentives so that actors contest routes, licenses and investment yet cooperate on safety, navigation, certification and information exchange; where interoperability is high, transaction costs fall and cross-border finance deepens, whereas normative divergence fragments sub-regions and inflates risk premia. Ecologically, rapid warming, permafrost degradation and intensifying extremes transform infrastructure from fixed assets into adaptive systems, exemplified by thermosiphons, floating foundations, digital-twin-based predictive maintenance and hybrid energy microgrids, while environmental governance becomes a constitutive layer of the regional operating system through strategic environmental assessment, zero-discharge practices, biodiversity-positive offsets and long-horizon monitoring that align ecological integrity with economic viability; inclusion-especially co-governance with Indigenous peoples and the integration of traditional ecological knowledge-underwrites social legitimacy and improves decision quality. As a policy system, the Arctic demonstrates a viable post-universalist globalization-connectivity without uniformity-whose consolidation depends on aligning safety, environmental and cyber standards across clusters, institutionalizing data-sharing architectures for ice, weather and permafrost, scaling adaptive engineering as a financing conditionality, formalizing co-governance with Indigenous communities and embedding green conditionality into capital flows, thereby sustaining managed interdependence that couples growth with ecosystem protection and stabilizes the world's foremost laboratory of infrastructural regionalism.

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