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Article

The cognitive heartland: A foundational framework for AI-driven reindustrialization as a spatial-economic resurgence of the American interior

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Abstract

The widespread notion of "heartland revenge" constitutes a significant misinterpretation. The American Interior is not nostalgically resurrecting antiquated factories but is instead evolving into a new, AI-driven industrial entity. This study asserts that Artificial Intelligence (AI) —via generative design, autonomous logistics, and predictive analytics—is methodically undermining agglomeration economies that have traditionally focused on advanced manufacturing in coastal and global megaregions. A novel spatial calculus has emerged, emphasizing the cost structures of interiors, land availability, and energy infrastructure. An empirical investigation of capital investment (2018-2024) in electric-vehicle battery factories, semiconductor fabrication facilities, and additive manufacturing sites identifies four bled mechanisms that facilitate a significant spatial-economic inversion. This transition is evidenced by the significant relocation of high-value production to the Midwest, South, and Great Plains. The primary contribution of this study is the formulation of "Cognitive Economic Geography," a fundamental framework that delineates how AI reconfigures comparative advantage, reduces efficient scale, and facilitates a polycentric, resilient production topology. This thorough analysis transcends basic political clichés, providing practical insights for politicians and corporate strategists as they navigate the significant transformations in capital, labor, and innovation.

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Introduction: From Nostalgic Narrative to Spatial-Economic Inversion

The recent inauguration of an AI-integrated battery gigafactory in rural Ohio presents a striking visual and economic contrast to the enduring vision of closed steel mills that have historically characterized the region. This facility shows how competitive priorities are translated into operational capabilities within the "Strategic Operations Nexus" framework under current technical conditions (Dzreke & Dzreke, 2026f). Widespread representations, such as "the heartland's revenge," inaccurately portray the transition by conflating structural reconfiguration with symbolic restoration (Krugman, 2018). A profound transformation is that artificial intelligence (AI) now functions as a dual-force spatial-economic disruption: it diminishes established geographic advantages while becoming essential to competitive strategy (Dzreke, 2025e). The phenomenon perceived as industrial resurgence is more

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precisely understood as an institutional and technological reconfiguration of production. The analytical objective is to elucidate why location is being redefined as a strategic determinant of AI-intensive production. “Strategic Operations Nexus” framework.

For decades, high-value manufacturing has adhered to a resilient model characterized by coastal and overseas concentrations, driven by agglomeration economics. According to Moretti (2012) and Glaeser (2000), companies congregate in regions such as Silicon Valley, the Boston corridor, and East Asian industrial centers because of the advantages of supplier density, specialized labor markets, logistical accessibility, and dissemination of tacit knowledge. Nonetheless, the concentration advantages also produced compounding vulnerabilities as operational expenses increased, transportation networks became clogged, and geopolitical and epidemiological disruptions spread across closely interconnected supply chains (Shih, 2023). Under these circumstances, efficiency improvements from density become progressively dependent rather than inherently assured. The outcome was a widening gap between the invention’s inception and the prospect of scalable production, particularly in capital-intensive industries that require high reliability and energy stability. This contradiction indicates that the existing geography was primed for disruption by a general-purpose technology that may transform coordination costs and risk management frameworks (Brynjolfsson & McAfee, 2024).

The primary assertion of this study is that AI is not merely automating tasks within established industrial landscapes; it is redefining the principles that govern their creation. By utilizing an “AI Co-pilot” feature, organizations may address fluctuating demand, supplier volatility, and logistical disruptions with greater adaptive accuracy (Dzreke, 2025d). By utilizing “Cognitive Orchestration,” organizations can integrate production, maintenance, inventory, and distribution into a cohesive intelligence framework, thereby reducing the traditional need for expert collaboration (Dzreke, 2026a). The aim is to transcend isolated case studies and provide a comprehensive analytical framework for AI-driven reindustrialization as a fundamental influence on American economic geography. This paradigm outlines the technological, economic, and infrastructural mechanisms that enable spatial inversion and explains why the nascent “Cognitive Heartland” should be viewed as structural rather than cyclical. The practical impact is evident, as policy, infrastructure financing, workforce design, and corporate site strategy now rely on decision-makers’ understanding that this inversion is enduring.

The postwar concentration paradigm correlated geographic density with innovation and productivity, creating ecosystems that were highly efficient under stable conditions but increasingly vulnerable under persistent volatility. Robustness relies on regular shipping routes, a plentiful supply of skilled labor, and efficient global sourcing, all of which became increasingly unreliable in the early 2020s (Reeves & Whitaker, 2023). Just-in-time inventory, formerly lauded for its efficiency, became a conduit for widespread disruption when transportation delays, component shortages, and workforce limitations coincided (Sheffi, 2022). In prominent locations, land shortages, regulatory delays, and wage inflation progressively undermine the economics of expanding sophisticated production, despite substantial innovation capabilities (Berger & Frey, 2022). A strategic stalemate ensued: the expertise necessary for electrification, precision manufacturing, and sophisticated materials remained centralized, while large-scale implementation in these regions grew increasingly impractical. The implication is not the elimination of agglomeration effects, but rather their subordination to resilience-adjusted performance metrics amid ongoing uncertainty.

Table 1. The Coastal Concentration Paradigm: Strengths and Emerging Vulnerabilities

Agglomeration Factor	Historical Strength (c. 1990-2020)	Emerging Vulnerability (Post-2020)
Specialized Labor Pools	Deep reservoirs of engineering, R&D, and technical talent.	Hyper-competition for talent is driving extreme wage inflation and turnover; physical presence is less critical across all roles.
Supplier Networks	Dense, proximate networks enabling just-in-time production and rapid prototyping.	Over-concentration creates systemic risk, including single-point failures during global crises (e.g., pandemics, trade disputes).
Knowledge Spillovers	Innovation is fueled by face-to-face interaction and serendipitous exchange.	Digital collaboration tools and virtual R&D platforms dilute the unique advantage of physical colocation.
Infrastructure & Logistics	Proximity to major container ports and international airports.	Congestion, delays, and soaring shipping costs undermine cost advantages; the rise of nearshoring reduces reliance on trans-oceanic routes.
Capital Access	Proximity to venture capital and financial hubs.	Proliferation of digital investment platforms and increased federal industrial policy directing capital inland.

The distribution of advanced manufacturing should not be mistaken for technical regression; it is enabled by AI capabilities that serve as a force multiplier for decentralized production intelligence. Predictive analytics and digital twins enable companies to simulate entire supply networks in silico, assess disruptions before their occurrence, and concurrently optimize cost, lead time, emissions, and dependability (Iliuță et al., 2024). AI-driven robots and computer vision reduce the reliance on localized skilled labor by enabling remote reprogramming, adaptive task execution, and precision quality control at scale (Brynjolfsson & McAfee, 2024). These advantages become strategically critical when incorporated into enterprise-wide orchestration frameworks that harmonize maintenance, procurement, manufacturing, and logistics as a unified adaptive system (Dzreke, 2025d, 2026a). An exemplary case is an AI-integrated gigafactory that dynamically adjusts the electrochemical throughput in response to real-time grid conditions and energy price fluctuations, enhancing yield stability while minimizing marginal operating costs (McKinsey & Company, 2023). The outcome is a shift from plant-level optimization to network-level intelligence, in which strategic performance depends on the quality of coordination rather than mere spatial proximity (Schneider & Kokshagina, 2021).

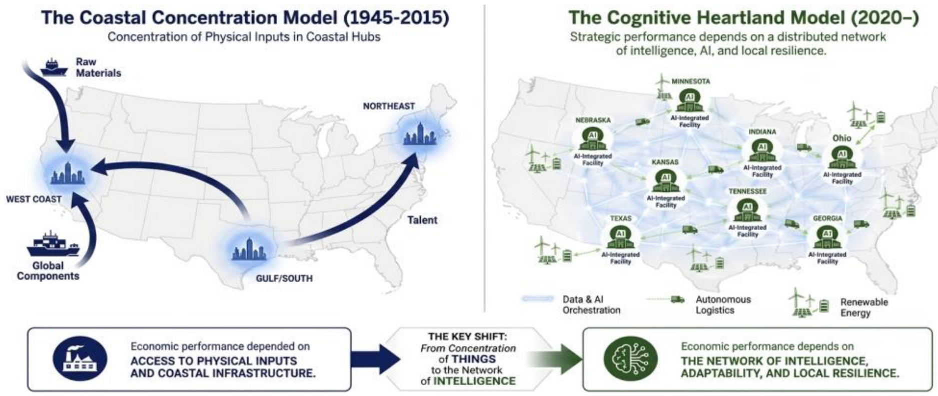

Figure 1. The Paradigm Shift in Advanced Manufacturing Geography

This shift is marked by a changing geography, with investments moving to areas that integrate physical and digital infrastructure to mitigate risks in AI-enhanced production. Data from megaproject siting demonstrate that reliable, inexpensive energy has become crucial due to the electrical demands of advanced manufacturing and extensive computing (McKinsey & Company, 2023). Inland freight access, multimodal connectivity, and continental distribution capacity are increasingly comparable to the advantages of proximity to deep-water ports owing to pressures from nearshoring and regionalization (Atkinson & Ezell, 2024). Extensive contiguous land parcels with substantial utility access, particularly for water and transmission, now significantly influence site feasibility, alongside tax incentives. Federal policy tools, such as the Inflation Reduction Act and the CHIPS and Science Act, can enhance these dynamics when coordinated with state-level workforce initiatives and consistent permitting processes (Atkinson & Ezell, 2024). This does not represent a uniform "rise of the rest " but rather a stratified internal hierarchy comprising Tier 1 Cognitive Hubs, Tier 2 Production Clusters, and Tier 3 Resource-Anchored Sites, structured by their alignment with cognitive production needs (Langley & Leyshon, 2023). A pragmatic comparison of analogous counties reveals a trend: jurisdictions that combine grid redundancy, technical college retraining programs, and rail intermodality attract multi-stage manufacturing, whereas those providing incentives without digital or energy preparedness attract only low-complexity spillovers.

Strategic implications encompass seating and capital allocation, as well as organizational design, governance, and workforce development. Organizations increasingly require operating models that consider remote facilities as elements of a unified adaptive system, with algorithmic coordination viewed as a fundamental strategic asset rather than merely a support function (Schneider & Kokshagina, 2021). This revolution has increased the need for hybrid competencies at the intersection of industrial engineering, data science, and cyber-physical operations management. Public policy faces a similar challenge: subsidy frameworks based solely on headline investment or employment figures may yield fragile growth unless they are linked to ongoing workforce development, digital infrastructure, and institutional learning capabilities (Atkinson & Ezell, 2024). Investment in broadband reliability, smart grid modernization, and cyber-physical security is essential, as production continuity increasingly relies on digital and electrical resilience (Shih, 2023). Proactive governance is essential for addressing distributional consequences, as AI-intensive facilities create employment profiles that differ fundamentally from those of previous industrial labor markets and may exacerbate regional inequality without coordinated education and lifelong learning systems (Berger & Frey, 2022). An effective strategy requires a renewed social compact that aligns technological advancement with inclusive capacity development across the country's diverse regions and demographics.

Conclusion: The Inversion as a Structural Reset

The emergence of the Cognitive Heartland signifies a fundamental spatial-economic transformation, in which AI diminishes the traditional value of physical proximity while simultaneously enhancing the importance of energy reliability, data infrastructure, and orchestration proficiency (Langley & Leyshon, 2023). Advanced manufacturing is being restructured into dispersed, intelligence-connected nodes optimized for resilience in unknown situations rather than static efficiency in equilibrium. An interdisciplinary examination encompassing economic geography, operations science, organizational theory, and infrastructure policy suggests that long-term advantage increasingly relies on systemic coordinating capacity rather than on inherited locational reputation. The immediate practical effect is that companies developing enterprise-scale orchestration capabilities are better equipped to manage the volatility. Simultaneously, regions that synchronize grid investment, logistics design, workforce institutions, and governance will achieve disproportionate advantages in advanced production. In contrast, symbolic reindustrialization that lacks cognitive and infrastructural depth is unlikely to yield sustainable competitiveness or widespread welfare gains. The critical policy and strategic objective is to manage this inversion as a long-term initiative focused on productivity, security, and inclusive prosperity, rather than as a transient spatial adjustment.

Literature Review: Agglomeration, Technology Shocks, and the New Economic Geography

Principles of Agglomeration Theory

The fundamental framework of economic geography has traditionally been based on agglomeration theory, which explains the persistent concentration of productive activities in urban areas and in industrial clusters. Marshallian externalities—labor pooling, specialized supplier ecosystems, and knowledge spillovers—are essential for understanding how density can produce cumulative advantages over time (Marshall, 1890). Jacobs (1969) nuanced this perspective by asserting that urban diversity, rather than limited specialization, frequently propels innovation through cross-sector recombination and cognitive friction. These discoveries were codified in New Economic Geography (NEG), in which increasing returns, transportation costs, and circular causality engender core-periphery outcomes endogenously rather than as historical contingencies (Fujita et al., 2001). Throughout most of the twentieth century and into the early twenty-first century, this paradigm accurately represented the rationale for urban supremacy (Glaeser & Gottlieb, 2009). However, its assumptions were formulated within technical frameworks in which tacit coordination, physical proximity, and face-to-face connections incurred high dispersion costs. The current analytical challenge is not to reject the agglomeration theory but to accurately determine which of its mechanisms persist as digital coordination increasingly replaces colocation.

Technology as a Spatial Disruptor

General-purpose technologies have consistently transformed economic landscapes by altering coordination costs, production constraints, and the geography of comparative advantage. Railroads reduced inefficiencies in inland transport, electrification detached manufacturing from reliance on water resources, and containerization restructured global value chains through standardized logistical interfaces (Berger, 2019). Artificial intelligence has now emerged as a system-level disruptor that alters both productivity trends and the configuration of strategic assets and industrial control structures. Strategic scholarship elucidates this transition via the Algorithmic-Based View (ABV), which asserts that inimitable advantages shift towards data architecture, model governance, and cyber-physical integration, rather than depending solely on conventional VRIN bundles (Dzreke & Dzreke, 2025k). This suggests that proximity-based advantages may diminish if algorithmic coordination can mimic or surpass the benefits of colocation, especially in forecasting, quality control, and supply synchronization (Brynjolfsson et al., 2023). A practical comparison is between a legacy cluster that relies on intensive, in-person supplier management and an AI-coordinated, dispersed network that enables dynamic sourcing and real-time process adjustments across remote sites. The pertinent theoretical implication is not the "death of distance," but rather the selective reassessment of distance facilitated by new coordination technologies.

The Constraints of Contemporary "Industry 4.0" Discourse

The Industry 4.0 literature remains conceptually a-spatial and methodologically firm-centric. Investigations into digital twins, smart factories, and industrial IoT have yielded substantial insights into operational enhancements, notably in predictive maintenance, throughput optimization, and defect mitigation (Zheng et al., 2023). This corpus frequently treats geography as a neutral backdrop rather than as an active variable shaped by infrastructure, institutions, and political economy. This perspective undervalues the extent to which regulatory differences, educational resources, labor market density, and the quality of local governance influence technological uptake and performance across areas (Gertler, 2022). The outcome is a stylized account of seamless diffusion that conceals the reasons why identically equipped companies yield different results across locations. An effective analysis of industrial transformation must link plant-level digital capabilities to regional factors that facilitate or hinder their expansion. This represents a comprehensive reevaluation of industrial modernity that contemporary scholarship advocates for, highlighting institutional disparities in technology transitions (Dzreke & Dzreke, 2025j). In the absence of this integration, assertions regarding technological convergence may appear descriptively refined but lack substantive explanatory depth.

Developing Research on Artificial Intelligence and Geography

An expanding corpus of research has examined the spatial implications of AI; however, the discipline remains theoretically inconsistent. One perspective views AI as a catalyst for developmental leapfrogging in services and production, particularly in contexts with weak legacy systems and opportunities for institutional experimentation (Cheng et al., 2023).

Another stream examines the material footprint of AI infrastructure, analyzing how compute-intensive systems create new geographies of energy demand, water stress, and land-use pressure resulting from the proliferation of data centers (Dodge & Kitchin, 2022). These contributions are significant as they illustrate AI's dual nature of being both dispersive and recentralizing, contingent upon the specific layer of the technology stack being examined. However, much of this research treats AI as a distinct entity rather than a relational system embedded within data pipelines, model-training cycles, and deployment architectures. An essential unresolved matter is the cyclical interaction between Big Data Analytics (BDA) and AI: BDA enhances model efficacy and contextual adjustment, whereas AI systems produce novel data structures that transform ensuing analytics and decision-making contexts. This recurrent dynamic is important for sustained advantage in spatially reconfigured production networks, although it has been inadequately hypothesized in the contemporary literature (Dzreke, 2025f; Agrawal et al., 2024).

Synthesis and Research Gaps

The literature indicates a disjointed yet promising field requiring conceptual unification across economic geography, strategy, and institutional analysis. Agglomeration theory is essential, but its fundamental assumptions regarding stable density premiums are being challenged by AI-driven coordination and ABV logic. Research on technological shocks has provided historical context but has frequently failed to adequately define their consequences for modern physical production systems, particularly outside ICT and service outsourcing sectors. Industry 4.0 scholarship provides detailed operational evidence but often overlooks regional diversity and the impacts of multilevel governance. Public discourse on regional revival often relies on symbolic narratives that inadequately serve as explanatory frameworks for structural transformation (Rodríguez-Pose, 2023). This study's paradigm rectifies these deficiencies by connecting firm-level algorithmic capabilities to macro-spatial consequences, designating Cognitive Orchestration as a causal mechanism, and seeing institutional variability as fundamental rather than incidental. This synthesis has a direct practical impact: it offers policymakers and businesses a robust framework for determining which locations might transform AI adoption into sustainable industrial capacity and which may make superficial announcements without substantial long-term development.

Table 2. Scholarly Gaps and This Framework's Contribution

Scholarly Focus	Key Limitation	This Framework's Contribution
Agglomeration Economics	Assumes persistence of scale/density premiums derived from physical proximity and shared infrastructure.	Models how the Algorithmic-Based View (ABV) (Dzreke & Dzreke, 2025k) erodes these premiums by enabling distributed coordination, thereby theoretically enabling new forms of economic dispersion.

Technology & Geography	Focuses historically on ICT and service offshoring, not on the reconfiguration of physical production geography.	Centers AI's applications in physical production and logistics, analyzing spatial outcomes through the lens of Cognitive Orchestration (Dzreke, 2026a) in manufacturing and supply networks.
Regional Revival	Often employs nostalgic, political, or place-based narratives lacking a granular techno-economic mechanism.	Provides a rigorous techno-economic analysis of revival potential via the Strategic Operations Nexus (Dzreke & Dzreke, 2026f), linking firm strategy to regional capability development.
Industry 4.0 Discourse	Predominantly a-spatial, focused on single-factory productivity and technological determinism.	Integrates firm-level AI adoption with systemic geographic outcomes, explicitly incorporating the mediating role of Institutional Heterogeneity (Dzreke & Dzreke, 2025j).

Theoretical Framework: Mechanisms of Spatial-Economic Inversion

Introduction to the Framework: Proposing Cognitive Economic Geography

The current reorganization of sophisticated manufacturing necessitates a theoretical framework that transcends traditional location theory and encompasses the cognitive restructuring of production systems. Cognitive Economic Geography is suggested as a comprehensive paradigm for elucidating how Artificial Intelligence (AI) and related cognitive technologies transform not just the locations of production but also the methods by which enterprises manage knowledge, risk, and execution across geographical spaces (Brynjolfsson & McAfee, 2023). In this narrative, AI is regarded not merely as a marginal efficiency instrument inside established agglomeration frameworks; rather, it is viewed as a structural force capable of overturning existing spatial-economic hierarchies by altering the relative value of location-specific assets (Isaksen et al., 2022). Historically advantageous coastal attributes—robust labor markets, localized knowledge spillovers, and port-related gateway effects—are being largely dismantled and redistributed via digital infrastructures for coordination, simulation, and control (Iammarino et al., 2019). Simultaneously, characteristics of interior regions that have hitherto been seen as secondary—reduced land expenses, scalable and reliable energy availability, central logistical positioning on the continent, and diminished geopolitical risk—gain primary strategic significance in AI-driven production environments. The outcome is better understood as re-territorialization rather than mere de-concentration, as production is not dispersing arbitrarily but reorganizing into a novel hierarchy of cognitively empowered nodes. This paradigm describes four interrelated ways by which AI modifies industrial location selection and operational resilience.

Fundamental Proposition: AI as a Dispersive Force and the Emergence of Internal Advantages

The fundamental assertion is that a counteracting tendency to agglomeration progressively influences twenty-first-century economic geography: AI generates a centrifugal dynamic that diminishes the scarcity value of skills that rely on colocation (Aoyama et al., 2017). Tacit knowledge, previously shared only in concentrated face-to-face settings, can now be partially codified, modeled, and disseminated through AI-enhanced collaborative spaces and digital twins, reducing the innovation premium associated solely with proximity (Glaeser & Potts, 2023). Concurrently, production cost frameworks are transitioning from labor- and urban-space-intensive to capital-intensive intelligent systems and energy-intensive computational processes, both of which exhibit greater spatial reconfigurability than traditional agglomeration assets (Acemoglu & Restrepo, 2022). This transition does not eradicate clustering; rather, it alters the focal points of clustering: coordination intelligence, grid dependability, multimodal inland logistics, and institutional execution capacity assume greater significance than historical reputation. Interior regions emerge not only as low-cost alternatives but also as strategically advantageous platforms for large-scale manufacturing amid uncertainty, especially when policy, infrastructure, and talent systems are integrated (Rodrik & Sabel, 2024). A practical comparison highlights the issue: a coastal manufacturer facing wage increases, regulatory challenges, and port congestion may maintain design superiority but struggle to scale, whereas an inland AI-managed facility can achieve comparable quality with reduced systemic vulnerability and faster adjustments to the throughput. Spatial economic inversion signifies a profound transformation in the production function.

The Four Mechanisms Enabled by AI

The initial mechanism, Generative Production, is based on a “Generative Capability Stack” that integrates generative design, AI-driven simulation, and digital twins to develop adaptive production intelligence that evolves with demand, materials, and supplier conditions (Dzreke & Dzreke, 2026e; Agrawal et al., 2024). This technique lowers the capital and expert density thresholds required to initiate or reconfigure lines, thereby reducing the minimally efficient size. It facilitates economically sustainable, high-mix, small-batch production, thereby reducing reliance on concentrated industrial zones (Brynjolfsson et al., 2023). The second mechanism, Cognitive Automation, broadens automation to encompass planning, exception management, and optimization, incorporating cognitive procurement and self-regulating operational ecosystems (Dzreke, 2026b; Dzreke & Dzreke, 2025h; Autor, 2022). This diminishes dependence on hyper-specialized coastal labor markets and amplifies the demand for hybrid supervisory and technical positions that numerous inland labor markets can fulfill at more affordable, cost-of-living-adjusted wage rates, especially when combined with expedited AI-assisted training frameworks (Deming & Noray, 2020). The third mechanism, Autonomous Intralogistics, utilizes AGVs, drones, and AI routing systems to restructure internal material movement, facilitating facility designs suited to machine logic rather than human travel limitations (Dzreke, 2025a; Kashem et al., 2024). The fourth mechanism, Predictive Resilience, employs analytical instruments such as the Geopolitical Resilience Matrix (GRM) and network digital twins to transition firms from fragile just-in-time global dependencies to regionally redundant, shock-absorbing structures (Dzreke, 2025c; Ivanov & Dolgui, 2022). Collectively, these techniques make internal advantages economically viable by linking land, energy, labor, and geographic positioning to cognitive coordination capabilities previously inaccessible at scale (Evenett & Baldwin, 2023; Bereitschaft, 2025).

Table 3. Summary of AI-Enabled Mechanisms of Spatial-Economic Inversion

Mechanism	Core AI Enabler	Spatial Logic	Key Interior Advantage Leveraged
1. Generative Production	Generative Capability Stack (Dzreke & Dzreke, 2026e)	Lowers the minimum efficient scale; enables small, smart factories.	Affordable land for distributed, horizontal facility layouts.
2. Cognitive Automation	Cognitive Procurement Engineering (Dzreke, 2026b)	Reduces dependence on hyper-specialized labor pools and shifts demand toward AI supervisors.	Larger, generally skilled workforce at lower cost-of-living-adjusted wages.
3. Autonomous Intralogistics	AGVs, drones, & AI optimization (Dzreke, 2025a)	Makes large, single-story facilities efficient; decouples design from labor intensity.	Abundant, cheap land for optimal, sprawling facility footprints.
4. Predictive Resilience	Geopolitical Resilience Matrix (Dzreke, 2025c)	Favors resilient, regionalized networks over fragile global chains.	Proximity to raw materials & continental markets; geopolitical stability.

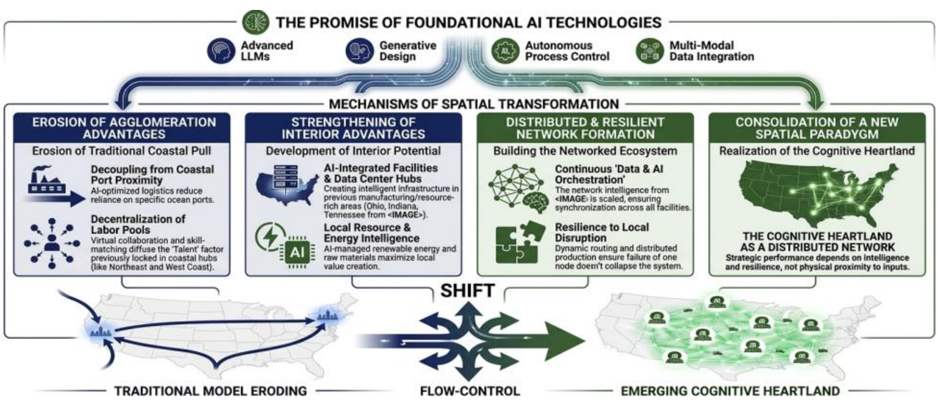

Figure 2. The Framework of AI-Driven Spatial-Economic Inversion

This schematic illustrates how foundational AI technologies activate four mechanisms that simultaneously erode traditional coastal agglomeration advantages and strengthen interior advantages, culminating in a new spatial paradigm: the Cognitive Heartland as a distributed, resilient network.

These four mechanisms collectively establish a causal framework for spatial-economic inversion within Cognitive Economic Geography, elucidating the necessity of analyzing AI transition as fundamentally geographical rather than solely technical (Glaeser, 2000). The framework's primary contribution is both explanatory and predictive: it reveals that dispersion pressures are escalating and specifies the routes through which location value is being recalibrated across regions. This enhances analytical accuracy for researchers investigating post-agglomeration processes and provides decision-relevant insights for companies and policymakers selecting among competing investment locations. A significant practical implication emerges: an industrial strategy that emphasizes incentives without concurrent investment in grid resilience, digital infrastructure, and workforce transformation is likely to underperform, even in low-cost areas. In contrast, jurisdictions that synchronize these complements can convert AI capabilities into sustainable regional development rather than temporary project acquisition. Cognitive Economic Geography reinterprets the current era as a structural competition for managed capability, in which locational advantages are progressively generated through synchronized intelligence embedded in institutions, infrastructure, and industrial networks.

Methodology & Empirical Scope

Comprehensive Analytical Methodology

This study employs an abductive, integrative research design to elucidate modern industrial reshoring as a causative process rather than merely a descriptive trend, merging theory creation with a multi-source empirical investigation (Timmermans & Tavory, 2022). The analytical architecture advances the concept of dynamic capabilities by establishing Big Data Analytics Capability (BDAC) as the foundational element that enables AI-driven sensing, seizing, and reconfiguration to operate effectively in uncertain environments (Dzreke & Dzreke, 2025; Warner & Wäger, 2019). Abduction is particularly suitable in this situation because the phenomenon under analysis—AI-enabled spatial-economic inversion—demonstrates novelty, institutional variability, and cross-level interconnections that cannot be adequately addressed by a single-paradigm deductive approach alone. The period from 2018 to 2024 is analytically significant, encompassing trade realignments, pandemic-related supply disruptions, rapid digitization, and substantial U.S. industrial policy interventions that collectively transformed corporate decision-making contexts. Interdisciplinary integration draws on strategic management, economic geography, operations science, and political economy to avoid explanatory reductionism and to identify mechanisms operating at the business, sector, and state levels. The methodological objective is to develop a theoretically rigorous yet empirically grounded paradigm that elucidates how BDAC affects the viability and effectiveness of AI-driven reshoring across various industrial contexts.

Triangulated Data Collection (2018-2024)

Empirical validation is achieved through a triangulated approach involving investment mapping, mechanism tracing, and institutional analysis, with each component serving a specific inferential function and collectively enhancing validity. Investment analysis systematically aggregates publicly disclosed U.S. manufacturing projects exceeding $500 million, categorized by sector—particularly semiconductors, electric vehicles/batteries, and pharmaceuticals—and by geography to discern clustering dynamics, sequencing effects, and sectoral divergence in locational behavior (Evenett & Baldwin, 2023). Secondly, causal-mechanism analysis integrates quantitative firm-level metrics with qualitative content evidence to evaluate whether enhanced BDAC correlates with an improved ability to identify supply chain vulnerabilities, seize reshoring opportunities, and adjust transnational production frameworks under time constraints (Dzreke & Dzreke, 2025; Mikalef & Krogstie, 2022). The analysis of policy documents investigates federal statutes, such as the CHIPS and Science Act and the Inflation Reduction Act, as well as state-level incentive frameworks, to position corporate strategy within an evolving landscape of strategic state intervention, including the interpretive significance of concepts like the "Ghana Flywheel" (Dzreke & Dzreke, 2025m). An illustrative example is found in battery supply chains, where companies with advanced data infrastructures have re-optimized sourcing and plant activation timetables in reaction to policy-related domestic-content regulations. Simultaneously, competitors with inferior data capabilities encountered compliance setbacks and budget overruns. Another example is semiconductor expansion, where integrated analytics enabled concurrent site selection, utility-risk modeling, and workforce pipeline projection, thereby reducing execution uncertainty despite capital intensity and permitting intricacies. Collectively, these streams produce a multifaceted empirical framework that integrates location, capability, and policy into a cohesive explanatory narrative of contemporary reshoring processes.

Recognized Constraints and Directions for Subsequent Inquiry

This framework study identifies the boundary criteria that effectively govern inference and delineate priority areas for future research. Reliance on publicly disclosed investment data, although crucial for transparency and reproducibility, creates an implementation gap, as announcements do not guarantee fulfillment; mega projects may be postponed, scaled down, or abandoned due to financial, regulatory, or technical limitations (Flyvbjerg, 2024). The current methodology prioritizes mechanism discovery and theoretical integration over the quantification of specific marginal impacts across sectors or geographies (Bennett & Checkel, 2024). These limitations represent an early-stage contribution to theory development rather than signs of analytical deficiency, as rigorous quantification requires stable datasets and more precise model specifications than the current transitional phase allows. Future scholarships should focus on the longitudinal tracking of project lifecycles from announcement to operational maturity to facilitate more robust assessments of execution risk, productivity outcomes, and regional spillovers. Complementary firm-level ethnographies and comparative process studies could elucidate the micro-foundations of BDAC development, including leadership routines, data governance practices, and cross-functional coordination structures that remain obscure in macro-level datasets. The practical implications of this objective are clear: more detailed evidence would enable policymakers to adjust incentives to showcase their execution capabilities. This would allow companies to assess their AI preparedness based on quantifiable changes in their strategic and operational performance rather than mere rhetoric.

Findings: The Evidence of Inversion

Empirical evidence demonstrates a distinct spatial and strategic reconfiguration in U.S. advanced manufacturing investment, referred to as "The Great Inversion." Since 2020, the previously prevalent coastal concentration model has given way to a significant shift toward the American interior for high-value projects, particularly in sectors where resilience, energy reliability, and digital integration are competitive advantages. Previous theories of low-wage arbitrage do not elucidate this phenomenon; rather, it is driven by AI-enabled systems' ability to orchestrate distributed production with high accuracy across geographically dispersed assets (Chen & Rolf, 2024). This trend aligns with the overarching ideas of structural industrial change, in which general-purpose technological platforms reorganize locational advantages rather than merely enhancing existing clusters (Markusen & Nesse, 2023). Data on investment flows, sectoral project design, and infrastructure co-location indicate a fundamental shift rather than a transient reaction to recent upheavals. Statistics indicate that areas integrating energy, freight flexibility, and interoperable digital capabilities are increasingly able to outpace traditional innovation regions in securing capital for large-scale deployment.

Macro Trend: The Critical Shift

Data from 2018 to 2024 indicate a significant and rapid shift in large facility announcements towards inland routes, notably the Ohio River Valley and Central Texas. Figure 3 illustrates that high-value investments in integrating energy, freight flexibility, and interoperable digital capabilities are progressively surpassing traditional innovation regions in attracting capital for large-scale deployment in batteries, semiconductors, and associated advanced manufacturing, which are now concentrated in interior regions aligned with strategic decoupling from vulnerable global supply dependencies (Bliznina, 2024). After the enactment of significant federal industrial laws, the total declared project value in key inland states surpassed that of traditional coastal technology centers, indicating a shift in the balance of concentration (Economic Innovation Group, 2024). The rationale for corporate site selection increasingly favors locations that offer complementary resources—reliable energy, diverse inland logistics, and scalable digital infrastructure—over mere proximity to traditional innovation hubs (Brynjolfsson & McAfee, 2024). The macro trend indicates a shift in risk-return expectations due to ongoing geopolitical and supply-chain uncertainties. A significant practical illustration is the distinction between coastal projects and an integrated model.

Sectoral Evidence

Sector-level analysis indicates that inversion is most prominent in three fundamental domains: electric vehicles/batteries, semiconductors, and additive manufacturing. In electric vehicle and battery manufacturing, megasites in Tennessee and Ohio serve as integrated ecosystems in which AI-driven robotics, quality analytics, and synchronized battery management systems reduce reliance on ultra-dense, just-in-time supplier networks (Dzreke, 2026a). The novel "Hub-and-Spoke 2.0" model in semiconductors positions megaprojects across Ohio, New York, and Texas, employing AI for process management, fault detection, and predictive defect mitigation, thus diminishing dependence on traditionally concentrated labor hubs (Dzreke, 2025b, 2025k). The proliferation of regional service bureaus in Indiana, Pennsylvania, and Texas, bolstered by generative design and algorithmic part optimization, facilitates advanced prototyping and limited-run fabrication nationally, independent of proximity to coastal R&D headquarters (Dzreke, 2026e). Collectively, these sectoral histories illustrate that AI modifies not just productivity at the facility level but also the structure of industrial geography throughout design-to-delivery chains. The analytical upshot is that locational advantage is increasingly derived from cognitive coordinating abilities rather than from inherited cluster density. Table 4 presents a synthesis.

Table 4. Evidence of Inversion by Sector

Sector	Exemplar Investments (Interior)	AI Link & Mechanism	Contrast with the Old Model
EV/Batteries	Ford BlueOval City (TN); LG/GM Ultium Cells JV (OH)	AI for battery management & Cognitive Orchestration for robotic assembly (M2, M3).	Traditional auto clusters required dense, tiered, just-in-time supplier networks.
Semiconductors	Intel New Albany (OH); Micron Clay (NY); Samsung Taylor (TX)	AI for fab process control & AI-based verification for defect prediction (M2); "Hub-and-Spoke 2.0" resilience.	Required hyper-specialized labor pools concentrated in Silicon Valley, Austin, or Phoenix.
Additive Manufacturing	Velo3D expansion (TX); Proliferation of regional service bureaus (IN, PA)	Generative design algorithms & Generative Capability Stack for part optimization (M1).	Prototyping and advanced fabrication were centralized in corporate or coastal engineering hubs.

Note. M1, M2, and M3 refer to the three mechanisms of inversion defined in the theoretical framework: M1 = AI-enabled task decomposition and dispersion; M2 = AI-mediated operational resilience; M3 = AI-facilitated cognitive integration.

The Enabling Infrastructure

This spatial reconfiguration relies on a simultaneous change in digital infrastructure, which serves as the coordinating foundation for distributed production systems (Teece, 2023). Two infrastructural tiers are critical for this. Computational geography indicates that hyperscale data centers are increasingly located alongside advanced manufacturing corridors, as AI-intensive operations require low-latency, high-bandwidth computing for scheduling, quality control, and real-time optimization (Andreessen & Horowitz, 2023). The second aspect is semantic interoperability, defined as an "Enterprise Lingua Franca" that facilitates the interpretability of data and instructions across diverse platforms and institutional barriers

(Dzreke & Dzreke, 2026d). This layer, grounded in industrial ontologies and AI-assisted translation, facilitates design, manufacturing, validation, and logistics across multiple areas while maintaining system coherence and comprehensive traceability (Iansiti & Lakhani, 2020). A practical example is a multistate production chain in which component designs are conceived in California, manufactured in Indiana, quality-assured in Ohio, and logistically coordinated from Texas, with no semantic discrepancies between the software and operational frameworks. The overarching consequence is that large-scale inversion requires not only manufacturing facilities and incentives but also interoperable digital institutions capable of transforming spatial dispersion into operational cohesion.

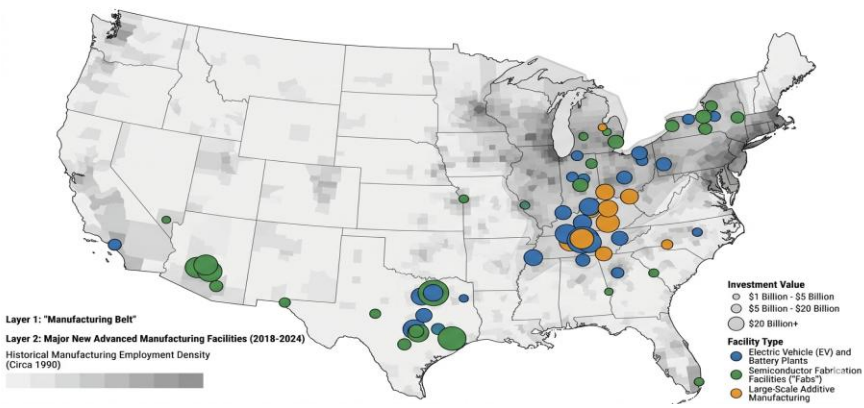

Figure 3. The Spatial Shift of U.S. Manufacturing Investment (2018-2024)

A cartographic representation of the contiguous United States. Layer 1, depicted in a light grey gradient, illustrates the historical density of manufacturing jobs in 1990, emphasizing the conventional "Manufacturing Belt" of the Upper Midwest and Mid-Atlantic regions. Layer 2 overlays have circular markers that are sized and color-coded to denote the location and declared investment value (scaled by circle size: $1-5B, $5-20B, $20B+) of significant new advanced manufacturing facilities (EV/battery, semiconductor, and large-scale additive) established between 2018 and 2024. The markers are predominantly concentrated in the interior: a dense aggregation in Ohio/Kentucky/Tennessee, substantial concentration in central Texas, and secondary clusters in upstate New York, Indiana, and Arizona. There is a clear visual difference between historical density and the current investment landscape.

Discussion: Consequences for Cognitive Economic Geography

The preceding analysis advocates for a significant redefinition of spatial economic organization into a dynamic, network-oriented framework, referred to as Cognitive Economic Geography (CEG). In this framework, value generation in AI-dominated economies is no longer predominantly based on fixed resource endowments but rather on geographically dispersed abilities for learning, forecasting, and synchronized adaptation (Müller & Kitchin, 2023). Thus, CEG reinterprets location theory by emphasizing the quality of algorithmic-processing ecosystems, institutional responsiveness, and human-machine complementarities, rather than relying solely on traditional proximity advantages. The primary thesis posits that sustainable regional development increasingly relies on Compound Advantage, a cumulative, synergistic interaction in which AI capabilities enhance human capital, optimize networks, and bolster adaptive resilience amid unpredictability (Dzreke & Dzreke, 2026c). This action broadens economic geography to encompass cognitive and infrastructural domains, focusing on how territories structure intelligence rather than solely on production inputs (Barns, 2024). The conceptual advantage is analytical precision: areas may be assessed not only by their assets but also by the efficacy of their orchestration across the digital, physical, and institutional dimensions. The practical implications are urgent for both research and policy, as growth trajectories now depend on the governance capacity to transform dispersed capabilities into coordinated, high-frequency problem-solving systems.

Formulating the Novel Discipline

The advent of CEG has significant ramifications for public policy, especially for regions still adhering to twentieth-century infrastructural paradigms that regard roads, land, and tax incentives as adequate tools for development. In modern contexts, physical infrastructure is essential yet insufficient; it must be integrated into a comprehensive strategy for "Architecting Prosperity," where institutional design, data governance, and adaptive capacity are equally vital to regional competitiveness (Dzreke & Dzreke, 2025g). Fundamental digital infrastructure—particularly resilient Digital Identity systems—acts as a crucial governance layer by diminishing transactional frictions, enhancing service targeting, bolstering trust in digital transactions, and expanding formal economic participation (Dzreke et al., 2025n; World Bank, 2023). When designed with privacy and interoperability measures in place, Digital ID can speed up business setup, enable workforce credential mobility, and improve access to financing, thereby strengthening the foundation of cognitive production systems. Industrial policy should be restructured to incentivize resilience, regional diversification, and verifiable AI implementation for locally relevant problem-solving, rather than depending exclusively on limited output measurements. An exemplary case is incentive design that ties subsidies to quantifiable advancements in cyber-physical infrastructure, completion of technical training, and supplier digitization rates, thereby aligning public spending with long-term capability development rather than immediate political visibility. The theoretical conclusion posits that CEG is not merely an abstract reclassification of regional economics but a policy-relevant framework for managing intelligent development amid systemic turbulence.

Consequences for Corporate Strategy

Corporate strategies must adapt to this new landscape, as traditional site-selection matrices that focus on labor costs, tax incentives, and transportation distances do not capture the critical aspects of AI-driven manufacturing. Location decisions increasingly require an assessment of the maturity of the local data ecosystem, the depth of AI talent, the clarity of cyber regulations, the stability of digital infrastructure, and the institutional capacity for expedited permitting and workforce adaptation (Iansiti & Lakhani, 2020). Competitive advantage is expected to accrue to enterprises that integrate operations within developing cognitive clusters, where suppliers, educational institutions, utilities, and public agencies collectively facilitate ongoing optimization rather than sporadic growth. This indicates that global learning must be formalized as a strategic function: organizations and policymakers should methodically evaluate transferable insights from scenarios such as Bangladesh's digitally enhanced textile competitiveness, where focused digital advancements enhanced quality consistency, export responsiveness, and productivity under stringent margin conditions (Dzreke & Dzreke, 2025i). The strategic priority is not the replication of sectoral models but the adaptation of fundamental coordination concepts to specific regional and industrial situations. An exemplary case is a sophisticated manufacturer that combines inland U.S. expansion with AI-driven supplier evaluation and remote quality assessment, focusing on labor costs, tax incentives, and transportation distances, yet fails to capture the value of export-manufacturing strategies in lower-cost regions to minimize defect variability and expedite onboarding processes. In CEG terminology, organizations thrive not by securing prestigious locations but by building exceptional coordination capabilities across distributed nodes.

Counterarguments and Contingencies

Any strong claim about cognitive decentralization must address substantial counterarguments, particularly the persistent advantages of innovation found in established mega-regions, which are defined by dense venture capital networks, esteemed research institutions, and tacit knowledge ecosystems that are difficult to replicate solely through digital methods (Florida & Adler, 2023). The preliminary phases of AI adoption may intensify concentration, as dominant firms in established hubs get disproportionate access to computational resources, specialized knowledge, and proprietary datasets. Thus, decentralization should be viewed as a contingent outcome rather than an unavoidable consequence of technological progress, depending on deliberate investments in digital infrastructure, institutional integrity, and regional interoperability. The reality of institutional variability between areas is equally significant. Local governance frameworks can either facilitate or hinder the implementation of AI-driven production systems based on regulatory adaptability, administrative efficacy, public-private partnership strategies, and the capacity to modify workforce development policies in response to evolving technological demands. Regions with flexible institutions are more likely to translate technical investments into productivity gains. In contrast, inflexible governance structures may create obstacles that hinder the dissemination of innovation and diminish the efficacy of cognitive production networks.

Ethical and governance issues persist, including algorithmic bias, insufficient transparency in model governance, labor surveillance, and disputes over data sovereignty, which can erode legitimacy and lead to unequal spatial outcomes if left unregulated (Bittencourt et al., 2025). Effective CEG requires the distribution of technology alongside robust governance frameworks to ensure accountability, transparency, and equitable access to digital public goods (DPGs). As cognitive production systems increasingly rely on an Enterprise Lingua Franca for interoperability among enterprises, suppliers, and institutions, governments must also confront data sovereignty issues. The advantages of uninterrupted information exchange must be weighed against the risks associated with centralized data governance, international regulatory disputes, and the vulnerability of proprietary company data. Ensuring interoperability necessitates secure governance frameworks, federated data-sharing models, standardized protocols, and explicit ownership guidelines that enable enterprises to communicate while safeguarding commercial security and regulatory compliance. Pragmatic protection entails establishing regional AI oversight frameworks that connect government bodies, corporations, and civil society experts to assess high-impact systems in recruitment, credit, and public service delivery before harm becomes entrenched. The primary conclusion is that CEG possesses substantial promise. However, its developmental and distributive benefits are contingent on institutional design decisions that align the pace of innovation with democratic legitimacy, social inclusion, and responsible data governance.

The Heartland as Cognitive Frontier

In conclusion, the revival of the American interior is better understood as a cognitive shift rather than a sentimental restoration, signifying a structural reconfiguration of the locus of value production. Its burgeoning advantage lies in its ability to accommodate AI-era productive infrastructure, including hyperscale data centers, specialized fabrication, grid-integrated renewable power, and interoperable digital systems (Chen & Srinivasan, 2023). This transition redirects regional development from traditional industrial density to computational capital, in which growth relies on the seamless coordination of data, energy, and output with minimal latency and maximum reliability (Chen & Wang, 2026).

Instead of symbolically challenging coastal metropolitan areas, the heartland reinforces the industrial-era belief that innovation and scale necessitate significant spatial concentration. The transition is both material and epistemological: distributed intelligence networks now execute functions previously associated with proximity, diminishing established agglomeration hierarchies (Dzreke & Dzreke, 2025k). In practice, companies are increasingly prioritizing grid resilience, fiber redundancy, and permitting efficiency over the signals of prestigious locations when locating modern equipment. Regions that build cognitive infrastructure as a public-private capabilities framework are well-positioned to shape the U.S. economic competitiveness of the coming era.

This reconfiguration presents significant potential for research and policy, particularly in how AI-mediated manufacturing transforms the microfoundations of agglomeration. Future research could examine whether the conventional agglomeration premium is diminishing, using frameworks such as the "Algorithmic-Based View," which considers computational access and orchestration capability as fundamental determinants of company advantage (Dzreke & Dzreke, 2025k). A comparative analysis of state and regional regimes—technology incentives, transmission planning, water governance, and industrial permitting—is crucial for elucidating the locational effects (Muro et al., 2023).

The distributional consequences necessitate ongoing examination. Cognitive infrastructure may amplify benefits while marginalizing adjacent regions, rendering the possibility of "data deserts" analytically significant unless governance is deliberately redistributive (Johnson & Scassa, 2023). Evidence indicates a divergence: counties that integrate technical college retraining with grid modernization are attracting multi-stage AI manufacturing, whereas demographically comparable counties lacking digital and energy preparedness are limited to low-value logistics. The competitiveness strategy must be evaluated not solely by the volume of investment but also by the institutions' ability to transform inflows into sustainable, inclusive capabilities.

In the future, the most likely U.S. economic landscape will integrate high-bandwidth data corridors, robust low-carbon energy systems, and logistics networks suited to autonomous supply chains. This spatial logic favors land scalability, energy stability, cybersecurity preparedness, and geopolitical dependability—conditions that are typically more achievable in inland areas than in traditional coastal hubs (Atkinson & Mayo, 2024b). In this design, the Cognitive Heartland serves as a central platform for national productivity, creativity, security, and industrial adaptation rather than a peripheral recovery zone. Companies using distributed, AI-managed models and governments that synchronize infrastructure, workforce systems, and regulatory enforcement will achieve disproportionate, long-term gains. However, superficial reindustrialization, lacking enduring digital-physical integration, may lead to lower-tier entrapment.

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References

Acemoglu, D., & Restrepo, P. (2022). Tasks, automation, and the rise in U.S. wage inequality. *Econometrica, 90*(5), 1973–2016. https://doi.org/10.3982/ECTA19815

Agrawal, A., Gans, J., & Goldfarb, A. (2024). *Power and prediction: The disruptive economics of artificial intelligence*. Harvard Business Review Press.

Andreessen, M., & Horowitz, B. (2023). *The new geography of compute: Data centers as the foundation of the AI-industrial complex*. A16Z Research.

Aoyama, Y., Powell, W. W., Saxenian, A., & Scott, A. J. (2017). The rise and fall of urban economies: Lessons from San Francisco and Los Angeles. *The AAG Review of Books, 5*(2), 146–157. https://doi.org/10.1080/2325548X.2017.1292591

Atkinson, R. D., & Ezell, S. J. (2024a). *The case for a national industrial strategy to counter China's rise*. Information Technology and Innovation Foundation.

Atkinson, R. D., & Mayo, M. J. (2024b). *The geography of resilience: Strategic infrastructure and American competitiveness*. Information Technology and Innovation Foundation.

Autor, D. (2022). *The labor market impacts of technological change: From unbridled enthusiasm to qualified optimism to vast uncertainty* (NBER Working Paper No. 30074). National Bureau of Economic Research.

Bennett, A., & Checkel, J. T. (2024). *Process tracing in the social sciences: From qualitative roots to best practices*. Cambridge University Press.

Bereitschaft, B. (2025). The shifting geography of innovation in the era of COVID-19: Exploring small business innovation and technology awards in the U.S. *Urban Science, 9*(8), 296. https://doi.org/10.3390/urbansci9080296

Berger, T., & Frey, C. B. (2022). Digitalization and the future of manufacturing: A regional perspective. *Journal of Regional Science, 62*(3), 564–585.

Bittencourt, J. C. N., Jesus, T. C., Peixoto, J. P. J., & Costa, D. G. (2025). The road to intelligent cities. *Smart Cities*, *8*(3), 77. https://doi.org/10.3390/smartcities8030077

Bliznina, N. (2024). Redefining economic growth for a green economy: A review of progress in Industry 4.0 and Industry 5.0. *Green and Low-Carbon Economy*. https://doi.org/10.47852/bonviewGLCE42021582

Brynjolfsson, E., & McAfee, A. (2023). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies* (2nd ed.). W. W. Norton & Company.

Brynjolfsson, E., Li, D., & Raymond, L. R. (2023). *Generative AI at work* (NBER Working Paper No. 31161). National Bureau of Economic Research.

Chen, L., & Rolf, S. (2024). Geopolitics, industrial policy, and the new domestic manufacturing landscape. *Review of International Political Economy*, *31*(2), 455–480. https://doi.org/10.1080/09692290.2023.2290123

Cheng, M., Fan, W., & Meng, F. (2023). Can artificial intelligence enable leapfrogging in developing economies? A review and research agenda. *Technological Forecasting and Social Change*, *186*, 122–135.

Chen, K., & Wang, X. (2026). The impact of intelligent computing centers construction on urban new-quality productivity: An empirical study based on 287 prefecture-level cities in China. *Socio-Economic Planning Sciences*. Advance online publication. https://doi.org/10.1016/j.seps.2026.102476

Chen, L., & Srinivasan, A. (2023). Infrastructure for intelligence: The spatial economics of AI hardware. *Journal of Economic Geography*, *23*(4), 891–917. https://doi.org/10.1093/jeg/lbad005

Deming, D. J., & Noray, K. (2020). Earnings dynamics, changing job skills, and STEM careers. *Quarterly Journal of Economics*, *135*(4), 1965–2005. https://doi.org/10.1093/qje/qjaa021

Dodge, M., & Kitchin, R. (2022). The (in)security of smart cities: Vulnerabilities, risks, resilience, and governance. *Journal of Urban Technology*, *29*(1), 1–19.

Dzreke, S. S. (2025a). Adapt or perish: How dynamic capabilities fuel digital transformation in traditional industries. *Advanced Research Journal*, *9*(1), 67–90. https://doi.org/10.71350/3062192584

Dzreke, S. S. (2025b). Hub-and-spoke 2.0: How Maersk's Panama mega-hub achieves 41% U.S.–Asia resilience, 28% LatAm cost savings, and 14% nearshoring surge. *Engineering Science & Technology Journal*, *6*(8), 468–484. https://doi.org/10.51594/estj.v6i8.2037

Dzreke, S. S. (2025c). Sovereignty arbitrage 5.3× ROI: Apple's $900 million strategic pivot and the geopolitical resilience matrix (GRM). *Engineering Science & Technology Journal*, *6*(8), 450–467. https://doi.org/10.51594/estj.v6i8.2036

Dzreke, S. S. (2025d). The AI co-pilot: Navigating market turbulence and charting a course for sustainable advantage. *International Journal of Management Science and Application*, *4*(2), 67–94. https://doi.org/10.58291/ijmsa.v4i2.442

Dzreke, S. S. (2025e). The competitive advantage of AI in business: A strategic imperative. *International Journal for Multidisciplinary Research*, *7*(4). https://doi.org/10.36948/ijfmr.2025.v07i04.50400

Dzreke, S. S. (2025f). The symbiotic interplay between big data analytics (BDA) and artificial intelligence (AI) in the formulation and execution of sustainable competitive advantage: A multi-level analysis. *Frontiers in Research, 4*(1), 35–56. https://doi.org/10.71350/30624533119

Dzreke, S. S. (2026a). Cognitive orchestration: The evolutionary advantage of AI in post-strategic enterprises. *Contemporary Perspectives, 2*(1), 60–77. https://doi.org/10.71350/3108610111

Dzreke, S. S. (2026b). Cognitive procurement engineering: A self-optimizing supply ecosystem for resilient energy grids. *Engineering Science & Technology Journal, 7*(4), 133–153. https://doi.org/10.51594/estj.v7i4.2249

Dzreke, S. S., & Dzreke, S. E. (2025g). Architecting prosperity: Public procurement as the foundational blueprint for Ghana's digital, green, and self-sufficient economic future. *International Journal of Latest Technology in Engineering Management & Applied Science, 14*(12), 359–375. https://doi.org/10.51583/IJLTEMAS.2025.1412000032

Dzreke, S. S., & Dzreke, S. E. (2025h). From intelligence to advantage: How competitive analysis drives profitability in the digital age. *International Journal of Research and Analytical Reviews, 12*(2), 804–828.

Dzreke, S. S., & Dzreke, S. E. (2025i). Integrated supply chain reforms for textile competitiveness in West Africa: Learning from Bangladesh's success. *Advanced Research Journal, 12*(1), 50–65. https://doi.org/10.71350/3062192598

Dzreke, S. S., & Dzreke, S. E. (2025j). Rethinking industrial modernity: Institutional heterogeneity and the limits of technological convergence. *Advanced Research Journal, 7*(1), 35–61. https://doi.org/10.71350/3062192566

Dzreke, S. S., & Dzreke, S. E. (2025k). The algorithmic-based view: Why data, models, and systems replace VRIN as the core of competitive advantage. *Computer Science & IT Research Journal, 6*(9), 602–615. https://doi.org/10.51594/csitrj.v6i9.2061

Dzreke, S. S., & Dzreke, S. E. (2025l). The causal mechanisms linking big data analytics capability (BDAC) to AI-driven dynamic capabilities: A mixed-methods investigation. *Computer Science & IT Research Journal, 6*(9), 616–631. https://doi.org/10.51594/csitrj.v6i9.2062

Dzreke, S. S., & Dzreke, S. E. (2025m). The Ghana flywheel: Modeling how strategic public procurement creates a self-reinforcing cycle of local industry growth, FDI attraction, and sustainable development. *International Journal of Latest Technology in Engineering Management & Applied Science, 14*(12), 343–358. https://doi.org/10.51583/IJLTEMAS.2025.1412000031

Dzreke, S. S., & Dzreke, S. E. (2026c). The compound advantage: AI as the engine for unassailable business growth. *Engineering Science & Technology Journal, 7*(1), 1–18. https://doi.org/10.51594/estj.v7i1.2190

Dzreke, S. S., & Dzreke, S. E. (2026d). The enterprise lingua franca: A foundational framework for semantic interoperability and cross-functional cognition. *International Journal of Management Science and Application, 5*(1), 1–18. https://doi.org/10.58291/ijmsa.v5i1.467

Dzreke, S. S., & Dzreke, S. E. (2026e). The generative capability stack: A foundational framework for adaptive, creative, and co-evolved supply chain intelligence. *Engineering Science & Technology Journal, 7*(1), 1–18. https://doi.org/10.51594/estj.v7i1.2189

Dzreke, S. S., & Dzreke, S. E. (2026f). The strategic operations nexus: A foundation for turning competitive priorities into operational capabilities and sustained advantage. *Engineering Science & Technology Journal, 7*(3), 114–132. https://doi.org/10.51594/estj.v7i3.2224

Economic Innovation Group. (2024). *The heartland high-tech boom: Tracking the post-2020 investment surge*.

Evenett, S. J., & Baldwin, R. E. (2023). *The COVID-19 pandemic and the reshaping of global value chains*. CEPR Press.

Flyvbjerg, B. (2024). *How big things get done: The surprising factors that determine the fate of every project, from home renovations to space exploration*. Currency.

Fujita, M., Krugman, P., & Venables, A. J. (2001). *The spatial economy: Cities, regions, and international trade*. MIT Press.

Gertler, M. S. (2022). The problem of regional "weakness" in innovation-driven economies: A demand-side perspective on regional innovation systems. *Regional Studies, 56*(5), 778–790.

Glaeser, E. L. (2000). The future of urban research: Non-market interactions. *Brookings-Wharton Papers on Urban Affairs, 2000*(1), 101–149.

Glaeser, E. L., & Potts, J. (2023). The new economics of urban agglomeration. *NBER Working Paper Series, No. 31028*.

Glaeser, E. L., & Gottlieb, J. D. (2009). The wealth of cities: Agglomeration economies and spatial equilibrium in the United States. *Journal of Economic Literature*, *47*(4), 983–1028.

Iammarino, S., Rodríguez-Pose, A., & Storper, M. (2019). Regional inequality in Europe: Evidence, theory and policy implications. *Journal of Economic Geography, 19*(2), 273–298.

Iansiti, M., & Lakhani, K. R. (2020). *Competing in the age of AI: Strategy and leadership when algorithms and networks run the world*. Harvard Business Review Press.

Iliuţă, M.-E., Moisescu, M.-A., Pop, E., Ionita, A.-D., Caramihai, S.-I., & Mitulescu, T.-C. (2024). Digital twin—A review of the evolution from concept to technology and its analytical perspectives on applications in various fields. *Applied Sciences*, *14*(13), 5454.

Ivanov, D., & Dolgui, A. (2022). Stress testing supply chains and creating viable ecosystems. *Operations Management Research*, *15*(1–2), 475–486.

Isaksen, A., Trippl, M., & Mayer, H. (2022). Regional innovation systems in an era of grand societal challenges: Reorientation versus transformation. *European Planning Studies, 30*(10), 1–14.

Jacobs, J. (1969). *The economy of cities*. Random House.

Johnson, P. A., & Scassa, T. (2023). Who owns the map? Data sovereignty and government spatial data collection, use, and dissemination. *Transactions in GIS, 27*(2), 379–396.

Kashem, M. A., Shamsuddoha, M., & Nasir, T. (2024). Digital-era resilience: Navigating logistics and supply chain operations after COVID-19. *Businesses, 4*(1), 1–17.

Krugman, P. (2018). Arithmetic, loss, and nostalgia. *The New York Times*.

Langley, P., & Leyshon, A. (2023). The platform and the plant: Towards a new geography of fintech and advanced manufacturing. *Environment and Planning A: Economy and Space*, *55*(5), 1125–1144.

Markusen, A., & Nesse, K. (2023). *Second-tier cities and regional resilience: Adaptation in the American economic landscape*. Brookings Institution Press.

Marshall, A. (1890). *Principles of economics*. Macmillan.

McKinsey & Company. (2023). *The future of advanced manufacturing in America: A new geography of investment*.

Mikalef, P., & Krogstie, J. (2022). Examining the interplay between big data analytics and contextual factors in driving process innovation capabilities. *European Journal of Information Systems, 31*(3), 260–287.

Moretti, E. (2012). *The new geography of jobs*. Houghton Mifflin Harcourt.

Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2023). *The new landscape of tech expansion: Tracking the geography of data center, semiconductor, and clean tech investments*. Brookings Institution.

Reeves, M., & Whitaker, K. (2023). The resilience paradox: Why being too efficient is risky. *MIT Sloan Management Review, 64*(3), 1–8.

Rodrik, D., & Sabel, C. (2024). *Building a good jobs economy*. Harvard Kennedy School Working Paper.

Rodríguez-Pose, A. (2023). The rise of populism and the revenge of the places that do not matter. *Cambridge Journal of Regions, Economy and Society, 16*(1), 1–20.

Sheffi, Y. (2022). *The new (ab)normal: Reshaping business and supply chain strategy beyond Covid-19*. MIT Press.

Shih, W. C. (2023). *The industrial policy comeback: Innovation and resilience in a changing world*. Harvard Business School Publishing.

Schneider, S., & Kokshagina, O. (2021). Digital transformation: What we have learned (thus far) and what is next. *Creativity and Innovation Management, 30*(2), 384–411.

Teece, D. J. (2023). *Dynamic capabilities and strategic management: Organizing for innovation and growth* (2nd ed.). Oxford University Press.

Timmermans, S., & Tavory, I. (2022). *Data analysis in qualitative research: Theorizing with abductive analysis*. University of Chicago Press.

Warner, K. S. R., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Planning, 52*, 326–349.

Zheng, T., Ardolino, M., Bacchetti, A., & Perona, M. (2023). The road towards Industry 4.0: A comparative study of the state-of-the-art in the Italian manufacturing industry. *Benchmarking: An International Journal, 30*(1), 307–332.