

AI Governance and Regional Inequalities: A Spatial Perspective on Policy Impacts in Europe

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1. Introduction

Artificial intelligence (AI) is reshaping governance, offering new ways to enhance administrative efficiency, optimise public service delivery, and drive economic development. Governments across Europe are embracing AI to improve policy design, automate decision-making, and refine regional planning. Yet, despite its transformative potential, AI's impact on regional inequalities remains an open question. While AI-driven policies could, in theory, help close the development gap between leading and lagging regions, the uneven distribution of digital infrastructure, expertise, and institutional capacity suggests a more complex reality (Rodríguez-Pose, 2018; Kitchin, 2021).

Regions equipped with advanced digital ecosystems and AI-ready institutions are well-positioned to leverage AI for economic growth and policy efficiency. Conversely, those with weaker digital infrastructure and fewer technological investments may struggle to integrate AI into governance, potentially exacerbating existing territorial disparities (Acemoglu & Restrepo, 2019). This raises critical questions: Does AI governance foster regional economic convergence, or does it reinforce existing spatial inequalities? How do interregional spillovers influence the distribution of AI-related benefits? Answering these questions is fundamental for understanding the territorial implications of AI adoption and ensuring that digital transformation policies promote inclusive growth (Bathelt & Glückler, 2011).

This study examines how AI-driven governance interacts with existing economic structures at the NUTS-2 regional level in Europe. It builds upon theoretical insights from regional innovation systems, spatial inequalities, and digital governance, using a spatial analytical framework to assess patterns of AI adoption, the effects of interregional spillovers, and the role of policy in either mitigating or exacerbating regional disparities.

2. Conceptual Framework and Literature Review

AI governance is increasingly recognised as a driver of economic and administrative transformation. AI-based decision-making tools, predictive analytics, and automation have already improved public services, enhanced urban mobility, and optimised regional development strategies. Yet, these innovations are not evenly distributed across Europe. The OECD AI Readiness Index (2021) highlights significant disparities in AI governance adoption, with technologically advanced regions displaying greater readiness to integrate AI into policy implementation. This disparity has sparked debates over whether AI will act as an equaliser, closing the gap between regions, or as a force for divergence, reinforcing the dominance of already competitive economic hubs.

The relationship between technological change and regional development has long been central to economic geography and innovation studies. Theories of regional innovation systems (Asheim & Coenen, 2005) suggest that regions with strong institutional networks, well-developed research ecosystems, and a culture of knowledge-sharing are better placed to absorb and capitalise on emerging technologies. AI follows similar patterns, where clusters of AI research institutions, digital industries, and a high-skilled workforce attract greater investment,

reinforcing economic agglomeration effects. Structurally weaker regions, by contrast, face barriers such as lower digital literacy, limited access to venture capital, and weaker policy support, making it harder for them to develop AI-driven governance capabilities.

The digital divide further compounds these disparities. Research on digital inequalities (Castells, 2010; Malecki, 2021) indicates that gaps in broadband access, AI-related workforce skills, and data accessibility all shape a region's ability to integrate AI into governance. The European Innovation Scoreboard (2022) finds that AI-related research and development (R&D) investments remain highly concentrated in a select group of leading regions, strengthening economic divergence rather than convergence. This suggests that AI's role in regional development must be understood within a broader context of spatial economic structures and technological diffusion.

Spatial spillover effects add another layer of complexity. Economic geography research has long shown that technological and policy innovations do not remain confined within administrative boundaries but instead generate spillovers, either positive or negative, for neighbouring regions (Bathelt et al., 2004; Boschma, 2005). In the case of AI governance, early-adopter regions may generate positive externalities by sharing knowledge, expertise, and best practices with surrounding areas. Conversely, negative spillovers could emerge if AI-driven economic advantages in leading regions lead to a concentration of AI-intensive industries and high-skilled labour, draining talent and investment from less-developed regions (Iammarino et al., 2019). Understanding these dynamics is essential for assessing how AI governance contributes to broader regional economic patterns.

3. Data and Methodology

This study adopts a spatial econometric approach to examine the relationship between AI governance and regional inequalities. The analysis focuses on NUTS-2 regional data across Europe, offering a more detailed assessment of spatial economic disparities. The dataset combines several publicly available sources: the OECD AI Readiness Index, which measures AI governance capabilities at the national level; the Digital Economy and Society Index (DESI), which provides indicators on regional digital infrastructure and AI adoption; the European Innovation Scoreboard, which tracks AI-related R&D investments and patent filings; and Eurostat Regional Statistics, which supply economic indicators such as GDP per capita, employment rates, and broadband penetration.

To detect clustering patterns in AI policy adoption and economic performance, the study employs Moran's I, a spatial autocorrelation measure that identifies the extent to which AI governance capabilities exhibit regional clustering. Additionally, spatial econometric models, including the Spatial Lag Model (SLM) and the Spatial Error Model (SEM), are used to evaluate whether AI adoption in one region influences economic outcomes in neighbouring areas. By integrating spatial analysis with economic geography theories, this study provides a nuanced understanding of the territorial dynamics of AI policy adoption.

4. Expected Contributions

This research contributes to both theoretical and policy debates on AI governance and regional development. First, it offers empirical insights into AI policy adoption at the regional level, addressing a gap in existing literature, which has largely focused on national AI strategies. By

constructing a Regional AI Policy Index, the study provides a novel tool for evaluating how AI governance capabilities vary across Europe and how they relate to economic performance.

Second, the study advances theoretical discussions on AI-driven spatial inequalities, demonstrating how digital infrastructure, innovation capacity, and institutional frameworks shape the ability of regions to integrate AI into governance. Third, through the application of spatial econometric techniques, it sheds light on the extent to which AI policies create interregional spillover effects, offering policymakers evidence-based insights into how AI governance can be leveraged to promote balanced economic growth.

Importantly, this study does not adopt a techno-pessimist stance. While AI governance poses challenges in terms of regional inequalities, it also presents opportunities for economic transformation and policy innovation. The findings will inform policy recommendations aimed at designing place-sensitive AI strategies that address regional disparities while maximising the potential benefits of digital transformation.

5. Initial Conclusion

As AI continues to shape public governance and economic systems, understanding its territorial effects is essential for ensuring that digital transformation fosters inclusive development. While AI-driven governance can enhance economic efficiency, it must be implemented with a keen awareness of regional disparities, ensuring that all regions, regardless of their current digital capabilities, can participate in and benefit from technological advancements.

This study underscores the importance of place-sensitive AI policies that acknowledge regional differences and encourage cross-regional collaboration. Future research should further explore the long-term implications of AI governance on regional economic resilience, ensuring that AI serves as a catalyst for territorial convergence rather than further economic polarisation.

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