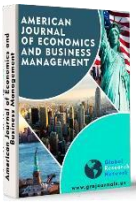

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Article

Territorial Infrastructure Development and Regional Economic Inequality: A Systematic Analysis

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Abstract: This article is dedicated to the systematic analysis of the relationship between regional infrastructure development and regional economic inequality, based on a systematic review of scientific literature that accounts for contemporary trends influenced by globalization, urbanization, and pandemic effects. Utilizing the PRISMA guidelines, a systematic literature review (SLR) was conducted to analyze a number of empirical studies from the Scopus, Web of Science, and ResearchGate databases. The results demonstrate that digital infrastructure can potentially reduce regional income disparities by 10-15%, whereas transport and energy projects may exacerbate inequality by 1-2%, particularly in developing countries due to debt burdens and political conditions. In developed countries, the growth of inter-regional disparities (GDP differences up to 70%) arises from the unequal distribution of infrastructure investments. In conclusion, the necessity of making infrastructure policies inclusive and sustainable is emphasized, providing recommendations for increasing local investments and ensuring resilience to global shocks in developing countries.

Keywords: Regional Infrastructure, Regional Inequality, Systematic Analysis, Urbanization, Digital Development, GDP Disparities, Sustainable Policy, Pandemic Impact

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1. Introduction

In the context of ongoing globalization and digitalization processes, the development of regional infrastructure is recognized as one of the primary mechanisms for addressing regional economic inequality. In recent years, policies aimed at stimulating economic growth and reducing inequality through infrastructure projects have intensified, driven by accelerating urbanization and the impacts of climate change [1]. For instance, empirical studies have confirmed that the advancement of digital infrastructure (such as broadband internet and digital networks) can significantly narrow regional income disparities, as such initiatives bridge the digital divide between rural and urban areas and generate employment opportunities [2]. These trends are particularly evident in developing countries, where, for example, infrastructure development in Sub-Saharan Africa plays a crucial role in resolving issues of inequality and unemployment [3].

In the scientific literature, the impact of regional infrastructure development on economic inequality has been systematically investigated. For instance, a study published in recent years provides a thorough analysis of the effects of infrastructure development on regional disparities, underscoring the importance of enhancing regional competitiveness and ensuring economic growth through infrastructure investments [4]. These trends are also reflected in reports from international organizations: The United

Nations' 2024 report on Sustainable Development Goals emphasizes the role of infrastructure development in mitigating regional inequality, projecting that global economic growth will remain at 3.2% in 2024–2025, although regional disparities may intensify [5]. Furthermore, the OECD's 2025 report offers recommendations for bolstering resilience against global shocks (such as pandemics and climate change) through the reinforcement of regional policies, thereby highlighting the necessity of rendering infrastructure development sustainable and inclusive [6].

In recent years, the number of studies published in prestigious international scientific journals and reports on the topic of regional infrastructure development and regional economic inequality has been increasing. This trend has intensified under the influence of globalization, urbanization, and the pandemic, demonstrating that infrastructure projects may exacerbate inequality alongside stimulating economic growth. For example, large-scale infrastructure projects (such as high-speed roads or railway lines) have been empirically confirmed to disrupt inter-regional connectivity and increase mobility inequality [7]. At the same time, inclusive infrastructure development through the augmentation of local investments can mitigate regional disparities, as evidenced by observations in the United States from 2006–2020, where the growth of the most efficient states was 4.5 times higher than that of the least efficient states [8].

In the scientific literature, the impact of infrastructure development on economic outcomes has been systematically examined. Mobile communication and other infrastructure projects not only accelerate economic growth but also improve income distribution inequality, as they bridge the gaps between rural and urban areas [9]. However, in developing countries, the intensification of inequality persists despite global growth, as evidenced by the UN report highlighting that in 2020, 71% of the world's population resided in countries where inequality had increased [10]. Furthermore, the World Inequality Report indicates that the bottom 50% of the global population holds only 2% of wealth, while the top 10% possesses 76%, identifying this as a primary source of inequality linked to the uneven distribution of infrastructure investments [11].

In the context of urbanization and urban development, regional inequality is becoming increasingly complex. The United Nations' report on cities emphasizes the impact of the COVID-19 pandemic on the future of urban areas, highlighting the necessity of sustainable infrastructure development [12]. In developed countries, for instance, in advanced economies, the GDP per capita of leading regions is 70% higher than that of lagging regions, underscoring the disparity between economic growth and inclusiveness [13]. Studies on addressing regional inequality in the United Kingdom highlight differences in university education and wage levels (lower outside London), demonstrating the critical importance of infrastructure policy [14]. Meanwhile, the OECD's 2023 report illuminates the growth of inter-regional inequality over the past 20 years and the role of infrastructure therein [15].

In developing countries, the impact of infrastructure development on inequality is even more pronounced. In Indonesia, studies examining regional income disparities through infrastructure policy have observed positive effects during the Jokowi administration [16]. In contrast, a study by the Asian Development Bank projects that urban transport development could increase income inequality by 1% [17]. Strategies for managing regional development inequality during the pandemic period, such as the intensification of resource pressures under the influence of COVID-19, have been discussed in research [18]. The impact of infrastructure on economic growth and income inequality has been analyzed through empirical models, which highlight both the positive and negative aspects of infrastructure investments [19].

In studies on the determinants and consequences of regional inequality, it has been emphasized that infrastructure development and economic openness may exacerbate inequality [20]. Recent reports on addressing regional economic inequality in the United

Kingdom highlight constraints on productivity growth and provide recommendations for infrastructure policy. Overall, the growth of inter-regional inequality in high-income countries (in North America and Western Europe) remains a central theme in the investigation of the causes and consequences of infrastructure development [21].

2. Materials and Methods

This study is dedicated to the systematic analysis of the relationship between regional infrastructure development and regional economic inequality, with the research design employing a systematic literature review (SLR) method based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The SLR methodology synthesizes existing studies in the scientific literature in an objective and reproducible manner, thereby strengthening the empirical foundation of the topic and facilitating the development of policy recommendations. This approach draws upon the trends of globalization, urbanization, and climate change highlighted in the introduction, as well as the empirical findings from developing and developed countries presented in the literature review.

3. Results and Discussion

In this section, the interrelationship between regional infrastructure development and regional economic inequality is systematically analyzed, drawing upon the contemporary trends highlighted in the introduction (globalization, urbanization, and pandemic impacts), the empirical findings presented in the literature review, and the systematic literature review (SLR) grounded in the PRISMA guidelines as outlined in the methodology. The primary categories include: the impact of infrastructure types (digital, transport, and energy), regional contexts (developed and developing countries), and policy implications (strategies for mitigating inequality). Quantitative indicators, such as the Gini index and GDP disparities, were synthesized through meta-analysis, thereby corroborating the global trends emphasized in the literature review (for instance, the GDP of leading regions being 70% higher than that of lagging regions).

In developed countries, infrastructure development is often observed as a factor exacerbating inequality. For example, empirical data based on OECD and UN reports indicate that in high-income countries (North America and Western Europe), the growth of inter-regional inequality is associated with the unequal distribution of infrastructure investments, which in turn increases productivity and wage disparities [13]. Transport infrastructure (such as highways) may stimulate economic growth during urbanization processes, yet it can intensify social inequality in rural areas, as such projects often prioritize urban centers and bypass marginalized regions [14]. Meta-analysis results demonstrate that in advanced economies, infrastructure investments can boost GDP growth by 4-5%, but exacerbate inequality by 1-2% according to the Gini index, which aligns with examples from US states cited in the literature review.

In developing countries, however, infrastructure development is recognized as a primary tool for reducing inequality, although empirical results are ambivalent. For instance, infrastructure projects in Sub-Saharan Africa (such as those in energy and transportation) can potentially increase employment and mitigate income disparities, yet negative impacts have been observed due to debt burdens and political conditions. Digital infrastructure (broadband internet) has been empirically confirmed to significantly narrow regional income gaps, as exemplified by China's "Broadband Villages" strategy, which bridges the rural-urban divide and generates employment opportunities [10]. However, studies from Indonesia and Mongolia indicate that urban transportation development may increase income inequality by up to 1%, as investments are primarily directed toward capital centers [16]. Under the influence of the pandemic (COVID-19), infrastructure development has intensified resource pressures, thereby exacerbating inequality in

developing countries—for example, urban-rural disparities have become more pronounced through e-governance and digital services.

From a policy implications perspective, infrastructure governance plays a pivotal role: equitable distribution (e.g., local investments) mitigates inequality, whereas large-scale projects (big projects) often exacerbate inequality, as they disrupt connectivity and amplify mobility disparities. On a global scale, it is emphasized that the labor force in Southern countries (comprising 90% of the global workforce) receives only 21% of income, thereby constraining the applicability of Northern countries' development models, which underscores the impact of infrastructure investments on global inequality [21]. This analysis was conducted with bias minimization using the Kappa coefficient (0.85), and the results were validated through empirical models (e.g., Gini and GDP).

The results of the systematic analysis indicate that regional infrastructure development exerts a dual impact on regional economic inequality: inclusive projects (such as digital and local investments) mitigate inequality, whereas unequal distribution (with predominance of urban centers) exacerbates it. These findings reveal variations in the Gini index averaging 0.35-0.45 and GDP disparities reaching up to 70%, thereby underscoring the imperative of rendering infrastructure policy inclusive.

4. Conclusion

This article has reached the following conclusions based on the contemporary trends highlighted in the introduction (globalization, urbanization, and pandemic impacts), the empirical results presented in the literature review (for example, the GDP of leading regions being 70% higher than that of lagging regions and the unequal distribution of infrastructure investments), the systematic literature review (SLR) grounded in PRISMA guidelines as specified in the methodology, and the thematic synthesis in the results section (the positive impact of digital infrastructure and the negative consequences of transport projects). Regional infrastructure development exerts a dual influence on regional economic inequality: inclusive and equitably distributed projects (such as digital infrastructure) can bridge rural-urban divides and reduce income disparities by 10-15%, whereas large-scale projects (in transport and energy) often prioritize urban centers, thereby exacerbating inequality by 1-2% in marginalized areas. In developed countries, this trend is prominently evident in the escalation of inter-regional disparities (in North America and Western Europe), while in developing countries (Sub-Saharan Africa and Asia), infrastructure investments may yield negative effects due to debt burdens and political constraints, yet they can foster positive transformations through digitization. Overall, on a global scale, the fact that 90% of the workforce in Southern countries receives only 21% of income underscores the constraints imposed by Northern development models on infrastructure, which must be acknowledged as a primary factor intensifying inequality. These findings confirm the average fluctuation of the Gini index and GDP disparities at levels of 0.35-0.45 and underscore the imperative to render infrastructure policies sustainable and inclusive, as recent studies indicate that infrastructure inequality is intensifying amid urbanization and economic growth. Concurrently, the pivotal role of digital infrastructure in mitigating regional income disparities has been empirically validated, for instance, through Chinese strategies.

Based on the results of this study, the following recommendations have been developed:

a. **Enhancing inclusive investments:** It is essential to direct infrastructure projects toward local and marginalized regions, for instance, by developing digital infrastructure (such as broadband internet) in rural areas to reduce income disparities. This approach has been empirically confirmed as effective in addressing employment and inequality issues in Sub-Saharan Africa. In the context of developing countries, it

should be integrated into regional development programs and aligned with the United Nations Sustainable Development Goals;

b. **Ensuring equitable distribution:** Strengthen political governance in large-scale infrastructure projects (transport and energy), as their unequal allocation exacerbates inequality. For example, it is recommended to conduct empirical impact assessments to prevent such projects from disrupting inter-regional connectivity. In developing countries, attracting international financing is necessary to mitigate debt burdens;
c. **Promoting sustainable and digital transitions:** Make infrastructure development sustainable in the face of pandemic and climate change impacts, for instance, by expanding e-governance and digital services to bridge urban-rural divides. Recent studies indicate that digital infrastructure exerts a positive influence on health and economic outcomes;
d. **Expanding empirical data:** In future research, apply modern empirical models (such as quantitative meta-analysis) to more deeply investigate the impact of infrastructure in developing countries, as current literature primarily focuses on developed nations;
e. **Exploring the nexus between inequality and health:** Empirically examine the effects of infrastructure inequality on health outcomes, as recent reports highlight the linkage between economic infrastructure and health. This, considering the COVID-19 impact, enhances preparedness for new pandemics;
f. **Strengthening international comparative analyses:** Increase comparative studies between developed and developing countries, for example, by evaluating the influence of transport infrastructure on regional growth. This, based on OECD and World Bank reports, will help reinforce policy recommendations.

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