

Interaction between Transport Systems and Regional Development: Analytical Insights from the Casablanca Metropolitan Area

Adnan EL BOUAZZAOUY (adnan.elbouazzaouy@outlook.com), Corresponding Author

Ph. D. Scholar, Hassan II University – ENCG Casablanca, Morocco

Mostapha AMRI (mostapha.amri@yahoo.fr), Professor, Hassan II University – ENCG Casablanca, Morocco



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Abstract: Transportation plays a central role in shaping regional development, serving as a strategic vector for territorial cohesion, economic integration, and sustainable mobility. This study investigates the relationship between transport infrastructure and regional development in the Casablanca metropolitan area, Morocco's economic capital. The objective is to assess the effects of recent public transport investments—particularly tramway and Bus Rapid Transit (BRT) systems—on accessibility, environmental performance, and spatial equity.

Methodologically, the research adopts a qualitative case study approach based on document analysis, urban mobility data, and field observations. The findings reveal significant modal shifts from private vehicles to public transit, a 33% reduction in average travel times, and a 37.5% decrease in CO₂ emissions between 2019 and 2024. However, challenges persist, including system saturation, unequal access in peripheral zones, and governance fragmentation.

To address these limitations, the paper proposes an integrated planning framework that combines inclusive territorial strategies with digital tools for real-time traffic management and multimodal coordination. The study offers actionable insights for policymakers and urban planners in the Global South seeking to design resilient and equitable transport systems. It contributes to the growing body of knowledge on sustainable urban development through infrastructure-led mobility transitions.

Keywords: Casablanca Metropolitan, Environmental Sustainability, Transport Infrastructure, Urban Mobility

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1. Introduction

Urban transportation systems play a critical role in shaping regional development, especially in emerging economies undergoing rapid urbanization and spatial transformation (Banister, 2008; Rodrigue, 2020). In the Moroccan context, Casablanca stands as the country's economic core, generating nearly 20% of the national GDP and concentrating key industrial, logistical, and financial activities. This urban primacy has led to intense demographic and spatial pressures, which in turn have placed considerable strain on the region's transport infrastructure.

Despite the presence of an extensive multimodal network—including highways, railways, port and airport platforms, and an expanding public transit system, Casablanca continues to face major challenges. Fragmented governance, unequal distribution of services, and rising congestion have undermined the performance of urban mobility (Cervero, 2017). Peripheral districts often remain poorly connected to economic hubs, exacerbating territorial inequalities and reducing access to opportunities (Litman, 2021). Recent planning instruments, such as the Urban Development Master Plan (SDAU) and regional mobility strategies, have sought to address these issues. However, implementation has been slowed by coordination failures, financial constraints, and the lack of adaptive, data-driven planning tools (Suzuki, Cervero, & Iuchi, 2013).

This paper examines the interaction between transport infrastructure and regional development, with the Casablanca metropolitan area as a case study. The objective is to assess how transport systems contribute to, or hinder—economic competitiveness, territorial cohesion, and environmental sustainability. Through a multidisciplinary lens combining economic geography and public policy analysis, the study addresses a central research question: **how can transport infrastructure in Casablanca be planned and governed to promote equitable and sustainable urban development?** By shedding light on both the transformative potential and structural limitations of current initiatives, this research contributes to a deeper understanding of mobility-led development strategies in the Global South. This paper argues that transportation infrastructure, when strategically integrated into urban planning and territorial policy, acts as a catalyst for inclusive economic growth, spatial justice, and sustainable regional development. Rather than being a

passive outcome of growth, mobility systems must be actively shaped to serve broader development objectives.

2. Materials and Methods

This research adopts a qualitative exploratory approach to examine the relationship between transportation infrastructure and regional development in the Casablanca metropolitan area. This methodology is appropriate when investigating complex socio-spatial phenomena in real-life contexts, especially when theoretical models are still being refined or contextualized (Yin, 2018). The choice of a qualitative framework allows for a deeper understanding of the dynamic interactions between mobility systems, governance structures, and territorial disparities in an emerging urban environment (Creswell & Poth, 2017).

A single-case study design was employed, focusing on Casablanca due to its strategic economic significance, demographic concentration, and diversity of modes of transport. Case study research is particularly suited for capturing the specificities of spatial governance and infrastructure investment in large urban systems (Stake, 2005). Data collection combined multiple sources to ensure triangulation and analytical robustness.

First, **secondary data** were collected from official reports and policy documents, including the Urban Development Master Plan (SDAU), regional planning strategies, and publications from the Moroccan Logistics Observatory. These documents provided quantitative indicators and institutional frameworks relevant to mobility and territorial development.

Second, **field observations** were conducted to assess infrastructure use, modal behavior, and accessibility in both central and peripheral districts. Observational methods were applied along major transport axes such as the tramway corridors and BRT lines, and in key intermodal hubs (e.g., Casa-Voyageurs station, Mohammadia port junction).

Third, a **thematic content analysis** was applied to synthesize the data. The analysis operated on two spatial scales:

- **Intra-urban mobility**, including tramways, BRT, conventional buses, and taxis
- **Interregional transport**, including highways, the port, the airport, and the high-speed rail (Al Boraq)

The analytical framework was grounded in the principles of **sustainable urban development** and **territorial equity**, focusing on how infrastructure affects accessibility, economic integration, and environmental outcomes (Banister, 2008; Litman, 2021). Particular attention was paid to the asymmetries between central and peripheral areas, the role of public investment in shaping modal shifts, and the governance mechanisms underpinning planning and implementation.

3. Results

This section presents the main empirical findings of the study, structured around four key dimensions of transport system performance: modal shifts, accessibility, environmental sustainability, and economic impact. The analysis compares quantitative indicators between 2019 and 2024, based on official statistics, local planning documents, and field observations conducted in Casablanca.

3.1. Modal Shift and Urban Mobility Transformation

Public investment in mass transit infrastructure has significantly transformed modal behaviors in Casablanca. Since 2020, tramway ridership has increased by 25%, reaching approximately 250,000 daily users, driven by the extension of lines T3 and T4. The launch of Bus Rapid Transit (BRT) lines BW1 and BW2 has added around 100,000 daily passengers, primarily in underserved neighborhoods such as Sidi Bernoussi and Ain Sebaa. In parallel, private vehicle usage has decreased from 35% in 2015 to 15% in 2024, indicating a substantial modal shift toward collective and low-emission transportation modes.

Mode of Transport	Usage Share (%)	Annual Growth
Tramway	20%	+ 25%
Bus Rapid Transit BRT	10%	+15% (estimated)
Conventional bus	30%	stable
Taxis	25%	-10%

Private Vehicles	15%	-20%
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Table 1: Modal Share in Greater Casablanca (2024)

Source: Author's calculations based on local transit data (2024).

3.2. Accessibility Gains and Travel Time Reduction

Infrastructure expansion has substantially improved accessibility in both central and peripheral areas. The proportion of urban territory covered by public transit increased from 40% to 60% between 2019 and 2024. Peripheral districts such as Hay Hassani and Mediouna now benefit from new tramway connections. Average travel times on tram lines have dropped from 45 to 30 minutes on critical axes, such as Sidi Maârouf–Casa-Port, while BRT services have reduced intra-urban travel durations by 15% on average.

Such reductions in time costs not only enhance economic efficiency but also improve daily life quality and access to jobs, education, and healthcare (Banister, 2008).

3.3. Environmental and Health Outcomes

The shift from private to public transport has contributed to tangible environmental improvements. Annual CO₂ emissions declined by approximately 150,000 tons, or 37.5%, between 2019 and 2024. Pilot projects for electrifying 10% of the urban bus fleet are under deployment. Air quality indicators, particularly in high-traffic areas like Maarif and the city center, show a 12% drop in PM_{2.5} concentrations, suggesting a reduction in respiratory risk exposure among urban populations.

These outcomes align with the international emphasis on low-carbon mobility in fast-growing cities (Rodrigue, 2020; UN-Habitat, 2022).

3.4. Economic Effects and Territorial Productivity

Transportation infrastructure development has generated positive economic spillovers. Between 2019 and 2024, more than 25,000 direct and indirect jobs were created in sectors linked to construction, operations, and maintenance. The transport sector now contributes approximately 18% of Casablanca's regional GDP—equivalent to 54 billion MAD—mainly through improved logistics performance and reduced intra-urban congestion. Furthermore, household mobility costs have dropped by an average of 15%, allowing users to redirect expenditures toward essential services.

Indicator	Before 2020	2024	Change (%)
Tramway Daily Ridership	200,000	250,000	+25%
Avg. Travel Time (minutes)	45	30	-33%
CO ₂ Emissions (tons/year)	400,000	250,000	-37.5%
Share of Sustainable Modes	30%	50%	+20%

Table 2: Comparative Performance Indicators (Before 2020 vs. 2024)

Source: Author's elaboration from municipal and logistics reports.

4. Discussion

The results of this study confirm that transport infrastructure plays a pivotal role in shaping regional development trajectories in emerging metropolitan contexts. In Casablanca, investments in tramway and BRT systems have generated substantial improvements in mobility, accessibility, environmental quality, and territorial performance. These outcomes support the central hypothesis that well-designed and inclusive transport systems can serve as powerful levers for spatial equity and sustainable urban growth (Banister, 2008; Cervero, 2017).

From a mobility perspective, the significant modal shift away from private vehicles toward public transit reflects the growing attractiveness of collective transport options in response to enhanced service quality and territorial coverage. This evolution aligns with the transit-oriented development (TOD) model, which emphasizes compact, accessible, and interconnected urban forms centered around high-capacity transport corridors (Suzuki, Cervero, & Iuchi, 2013). However, peak-hour saturation of tramway and BRT lines indicates operational limitations that threaten the continuity of this transition. Without short-term investment in rolling stocks, better frequency management, and station capacity, user satisfaction may decline, prompting a return to individual modes.

In terms of spatial justice, the integration of peripheral areas such as Hay Hassani and Mediouna into the metropolitan transit grid represents progress toward territorial cohesion. Yet, other marginalized zones—such as parts of Nouaceur and semi-rural communes—remain disconnected, reinforcing socio-spatial exclusion. This situation is consistent with Litman's (2021) findings on transport equity, which show that marginal gains in accessibility do not automatically translate into systemic inclusion without targeted policies and infrastructure densification.

Environmental performance indicators are also encouraging. The 37.5% reduction in annual CO₂ emissions and 12% decline in PM_{2.5} concentrations demonstrate the environmental benefits of shifting toward low-carbon transit systems. These achievements mirror international experiences where electrification and modal transfer have significantly reduced the urban carbon footprint (Rodrigue, 2020; UN-Habitat, 2022). Nonetheless, the environmental gains observed in Casablanca remain fragile in the absence of a coherent green mobility strategy, sustained energy transition, and strong policy enforcement mechanisms.

Economically, the expansion of public transport has contributed to job creation, reduced household mobility costs, and increased productivity through time savings and better inter-district connectivity. However, these benefits remain unevenly distributed. Most economic opportunities and investments continue to concentrate in central Casablanca, while suburban districts still face underinvestment. As noted by Bertolini et al. (2015), transport infrastructure must be coupled with complementary spatial planning and land-use reforms to generate long-term territorial value.

Governance remains the most critical constraint. While national strategies such as the SDAU provide strategic direction, implementation suffers from institutional fragmentation, a lack of inter-agency coordination, and limited stakeholder participation. The introduction of integrated governance bodies, digital planning tools (e.g., GIS and traffic simulation), and participatory decision-making frameworks could mitigate these weaknesses and ensure more adaptive and inclusive mobility governance (Papa & Bertolini, 2015).

In summary, Casablanca's case offers both inspiration and caution. It illustrates how transport investments can catalyze inclusive urban transformation, while also revealing the structural and institutional reforms required to ensure long-term effectiveness. These findings have broader relevance for other fast-growing cities in the Global South that seek to manage mobility transitions amid rapid urbanization and socio-economic disparity.

The findings support the central argument that mobility infrastructure is not merely a technical response to urban congestion but a structuring force capable of reshaping territorial dynamics, addressing socio-spatial disparities, and enabling long-term resilience when embedded in inclusive and coordinated governance models.

Limitations: However, the analysis also revealed persistent structural challenges that hinder the full potential of transport as a development lever. These include the saturation of key transit lines during peak hours, uneven coverage of peripheral districts, and institutional fragmentation in governance and planning processes. Without corrective measures, these weaknesses risk reinforcing rather than reducing spatial inequalities, as highlighted in similar urban contexts across the Global South (Litman, 2021; Bertolini et al., 2015).

To address these limitations, this paper advocates for an integrated and inclusive urban mobility strategy that rests on four pillars:

- **Territorial rebalancing**, through targeted investments in underserved zones such as Nouaceur and Mediouna.
- **Multimodal coordination**, by improving connections between tramways, BRT, regional trains, and informal modes.
- **Digital governance**, via real-time data systems (e.g., GIS, predictive traffic models) to enhance planning and responsiveness.
- **Participatory planning**, involving citizens and local stakeholders in transport design and evaluation processes.

By consolidating these pillars, Casablanca could build a more resilient and equitable urban mobility system, aligned with international goals of sustainable territorial development (UN-Habitat, 2022). Beyond the Moroccan context, the findings presented here may inform broader debates on how transport infrastructure can be mobilized as a policy tool to reduce territorial disparities, promote social inclusion, and foster green growth in emerging metropolitan regions. In sum, this research reaffirms the idea that transportation infrastructure, when guided by principles of territorial equity and sustainability, is a powerful instrument for reimagining metropolitan futures across the Global South.

5. Conclusion

This study examined the relationship between transportation systems and regional development in the Casablanca metropolitan area, highlighting how infrastructure investments can serve as vectors of inclusive growth, spatial equity, and environmental sustainability. The empirical results demonstrated that recent developments—particularly the expansion of the tramway and the launch of Bus Rapid Transit (BRT) services—have improved accessibility, reduced travel time, lowered CO₂ emissions, and contributed to job creation and territorial productivity.

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Conflict of Interest: The authors declare “No conflict of interest”.