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REVIEW

Algorithmic Governance in Urban Mobility: The Role of Artificial Intelligence in Public Transport Decision Making

Gobernanza Algorítmica en la Movilidad Urbana: El Rol de la Inteligencia Artificial en la Toma de Decisiones del Transporte Público

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ABSTRACT

The emergence of Artificial Intelligence (AI) is reshaping urban mobility governance, promising unprecedented optimization in public transport decision-making. This transition to "algorithmic governance" raises questions about its real impact beyond operational efficiency. The objective of this study is to critically analyze the scientific literature (2020-2025) to assess the balance between techno-economic advances and socio-political challenges (equity, transparency, and accountability) in the implementation of AI in public transport management. A systematic literature review (SLR) methodology was implemented under the PRISMA protocol. Eighty-nine articles extracted from Scopus and Web of Science were analyzed using critical thematic analysis to identify dominant paradigms and research gaps. The results reveal a hegemonic bias (85 % of the studies) toward "technological solutionism," focused on route optimization and the reduction of operating costs. There is a severe lack of research on algorithmic auditing mechanisms and participatory governance frameworks. We conclude that the inherent opacity (the "black box" problem) and the prioritization of efficiency over social equity are generating new forms of digital exclusion and weakening public decision-making sovereignty. Academia is urged to reorient research toward algorithmic justice in mobility.

Keywords: Algorithmic Governance; Artificial Intelligence; Urban Mobility; Public Transport; Equity and Transparency.

RESUMEN

La irrupción de la Inteligencia Artificial (IA) está reconfigurando la gobernanza de la movilidad urbana, prometiendo una optimización sin precedentes en la toma de decisiones del transporte público. Esta transición hacia la "gobernanza algorítmica" plantea interrogantes sobre su impacto real más allá de la eficiencia operativa. El objetivo de este estudio es analizar críticamente la literatura científica (2020-2025) para evaluar el balance entre los avances tecno-económicos y los desafíos socio-políticos (equidad, transparencia y rendición de cuentas) en la implementación de la IA en la gestión del transporte público. Se implementó una metodología de revisión sistemática de literatura (SLR) bajo el protocolo PRISMA. Se analizaron 89 artículos extraídos de Scopus y Web of Science, utilizando un análisis temático crítico para identificar paradigmas dominantes y vacíos investigativos. Los resultados revelan un sesgo hegemónico (85 % de los estudios) hacia el "solucionismo tecnológico", enfocado en la optimización de rutas y la reducción de costos operativos. Se constata una escasez severa de investigación sobre los mecanismos de auditoría algorítmica y los marcos de gobernanza participativa. Concluimos que la opacidad inherente (el problema de la "caja negra") y la priorización de la eficiencia sobre la equidad social están generando nuevas formas

de exclusión digital y debilitando la soberanía decisional pública. Se urge a la academia a reorientar la investigación hacia la justicia algorítmica en la movilidad.

Palabras clave: Gobernanza Algorítmica; Inteligencia Artificial; Movilidad Urbana; Transporte Público; Equidad y Transparencia.

INTRODUCTION

The Mirage of Algorithmic Efficiency

Contemporary urban mobility faces a structural crisis of congestion, sustainability, and equity in access.[1] In response, Artificial Intelligence (AI) has emerged as the dominant paradigm for the reconfiguration of public transport systems. The promise is clear: through *big data*, *machine learning*, and real-time optimization, AI can revolutionize route planning, fleet management, and demand forecasting, leading to a more efficient, sustainable, and responsive transportation system.[2]

Academic literature from the last five years reflects an almost ubiquitous enthusiasm for this potential. Studies have predominantly focused on the technical dimension of optimization.[3] For example, Ye et al.[2] demonstrate improvements of up to 30 % in operational efficiency through deep learning algorithms for demand forecasting. Similarly, work on *Mobility as a Service* (MaaS) relies on AI as the central driver for integrating disparate transportation services.[4] However, this hegemonic focus on operational efficiency, while technically valuable, obscures the profound political and social implications of transferring critical decision-making to algorithmic systems.

This article takes a critical stance toward this prevailing narrative. We argue that the current discourse suffers from "technological solutionism",[5] a term that describes the belief that complex social problems, such as transportation inequality, can be solved with a layer of sophisticated technology, ignoring their structural roots. rgorithmic governance is not a neutral tool; it is a political act that encodes values, prioritizes outcomes, and redistributes power.[6]

The research gap we address is therefore the lack of critical scrutiny of *how* these algorithms are governed. Existing literature rarely questions the provenance of training data (often biased), the opacity of proprietary models (the "black box"), or who is responsible when an algorithm discriminates.[7] As Marsden et al.[1] point out, the "datafication" of transportation is creating new centers of power, often in the hands of private technology corporations, with minimal public oversight.

Current research fails to ask: Efficiency for whom? Optimization to what end? And transparency for whom?[8] If an AI algorithm decides to reduce bus frequency in low-income neighborhoods due to "historically low demand" (data that reflects past exclusion, not future need), it is not optimizing public service; it is codifying inequality.[9] This article, through a systematic review, seeks to dismantle the narrative of neutral efficiency and expose the political dimension of AI in public transportation.

This systematic review differs fundamentally from previous work, such as that of Jittrapirom et al.[4] or Li et al.[3], which has focused on synthesizing technological *capabilities*. Our approach, instead, aligns with the growing demand for "applied algorithmic ethics".[10] We argue that "algorithmic governance" in transportation cannot be relegated to an engineering problem; it is a central challenge of public policy and social justice.[6] The literature has been prolific on the *what* (what AI can do) but critically deficient on the *how* (how it should be democratically governed).

To fill this gap, the article is structured as follows: Section 2 details the systematic literature review (SLR) methodology, describing the PRISMA protocol, search strategies, and analysis criteria. Section 3 presents the results of the review, quantifying the thematic bias of the literature and qualitatively analyzing the findings around efficiency, equity, and transparency. Section 4 discusses the implications of these results, contrasting the discourse of " -technological solutionism" with the imperatives of democratic governance. Finally, section 5 offers conclusions, highlighting the limitations of the study and proposing a future research agenda focused on algorithmic justice for urban mobility.

METHOD

To ensure the rigor, transparency, and replicability of the analysis, this study adopted the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol.[11] The Systematic Literature Review (SLR) methodology is the most appropriate for synthesizing an emerging body of knowledge, identifying consensus, exposing dissonance, and, crucially, locating research gaps.[12]

Search Strategy and Data Sources

The objective was to capture the most relevant and recent academic literature. Two high-impact

multidisciplinary databases were selected: Scopus (Elsevier) and Web of Science (WoS) Core Collection (Clarivate Analytics). The time range of the search was limited to January 1, 2020, to March 1, 2025, to focus the analysis on the most contemporary state of the art, coinciding with the post-pandemic explosion of applied AI.

A robust search string was designed to balance sensitivity (capturing all relevant articles) and specificity (excluding irrelevant noise). The string was adapted to the syntax of each database and combined three conceptual blocks (AI Terms, Transportation Terms, and Governance Terms) using Boolean operators (AND/OR).

The base search string (Scopus syntax) was as follows:

(TITLE-ABS-KEY (“artificial intelligence” OR “algorithmic governance” OR “machine learning” OR “big data” OR “automated decision-making”) AND TITLE-ABS-KEY (“public transport*” OR “urban mobility” OR “public transit” OR “mobility as a service” OR “MaaS”) AND TITLE-ABS-KEY (“governance” OR “policy” OR “ethics” OR “equity” OR “transparency” OR “accountability” OR “fairness” OR “decision-making”)) AND (PUBYEAR > 2019) AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “re”)) AND (LIMIT-TO (LANGUAGE, “English”))

Inclusion and Exclusion Criteria (Screening)

After running the search, the initial results from both databases were consolidated and deduplicated. Two reviewers (the lead author and a research assistant) conducted the screening process independently to minimize selection bias. Discrepancies were resolved by consensus or, if they persisted, by consultation with a third senior reviewer.

The selection process was carried out in two phases:

1. Phase 1 (Title and Abstract): The following inclusion (IC) and exclusion (EC) criteria were applied.
    - IC-1: The article explicitly addresses the use of AI (or associated technologies such as ML/Big Data) in the context of urban public transport or MaaS.
    - IC-2: The article discusses, even tangentially, aspects of governance, policy, decision-making, ethics, or social implications (equity, transparency).
    - EC-1: Purely technical articles (e.g., development of a new route optimization algorithm) that do not mention governance or decision-making implications (Studies such as Li et al.[3], were critically examined; if they only mentioned “improved decision-making” in a technical sense, without socio-political context, they were excluded).
    - CE-2: Articles focused on private mobility (e.g., private autonomous vehicles, Uber/Lyft-type *ride-hailing*) that do not integrate with public transportation.
    - CE-3: Grey literature (non-peer-reviewed conference reports, book chapters, *working papers*).
2. Phase 2 (Full Text): Articles that passed Phase 1 were read in their entirety to confirm their final eligibility, applying the same criteria in greater depth.

Selection Process (PRISMA)

Figure 1. PRISMA Flow Diagram of the Literature Selection Process

The initial search yielded 1 452 records (Scopus: 834; WoS: 618). After removing duplicates (n=211), 1 241 unique articles remained. Screening of titles and abstracts (Phase 1) excluded 1 098 articles for not meeting the criteria (mainly CE-1, being purely technical works). The remaining 143 articles were evaluated in full text

(Phase 2). At this stage, 54 articles were excluded (e.g., exclusive focus on cargo logistics, lack of discussion on governance). Finally, 89 studies were included in the qualitative synthesis and thematic analysis.

The complete flow of the selection process is detailed in the PRISMA diagram (figure 1).

RESULTS

Analysis of the 89 selected articles reveals marked patterns in the literature on algorithmic governance and public transportation. The most significant finding is the extreme thematic imbalance: an overwhelming majority of research focuses on technical optimization, while the critical dimensions of governance—equity, transparency, and participation—are systematically marginalized.

Our review classified each article according to its **main thematic focus**. The quantitative results of this classification are presented in table 1.

Table 1. Thematic and Methodological Classification of the Articles Analyzed (n=89)

Main Thematic Focus	Topic Description	No. of Articles	Percentage (%)
Efficiency and Optimization	Studies focused on improving operational performance: route optimization, demand forecasting, fleet management, cost reduction.	76	85,4
Equity and Social Justice	Studies analyzing algorithmic bias, the distributive impact of AI, the accessibility gap, and justice in transportation.	6	6,7
Transparency and Accountability	Studies focused on the "black box," the auditability of algorithms, explainability (XAI), and legal/public accountability frameworks.	5	5,6
Participatory Governance	Studies exploring the role of citizens in the design and oversight of AI systems (e.g., *co-design*, public *data trusts*).	2	2,3
Total		89	100,0

As table 1 shows, 85,4 % of the relevant literature (76 out of 89 articles) places efficiency and optimization as its central research objective. In contrast, less than 7 % of the studies address equity, and only 5,6 % focus on transparency. Citizen participation is almost non-existent (2,3 %).

This imbalance confirms the initial hypothesis of "technological solutionism".[5] The research community has prioritized *how to make the system faster* over *how to make it fairer*.

Dominant Topic: Efficiency as an End in Itself

The "Efficiency and Optimization" cluster (n=76) is characterized by an engineering approach. Papers in this category, such as those by Li et al.[3] and Ye et al.[2], use sophisticated quantitative methodologies (simulations, *deep learning* models) to propose operational improvements. While these studies mention "decision-making," they do so in a purely technical sense: "The model improves decision-making by selecting the optimal route".[2]

The criticism of this literature, based on our review, is not that efficiency is undesirable, but that it is presented as a neutral and apolitical goal. These articles [4] systematically omit discussion of the *trade-offs* inherent in such optimization. For example, optimizing operating costs can lead to the elimination of "inefficient" routes in low-density or low-income areas, directly impacting the most vulnerable populations.[9]

DISCUSSION

The findings of this systematic literature review (SLR) highlight a profound imbalance in research on algorithmic governance in urban mobility, where the predominance of technological solutionism overshadows critical considerations of equity, transparency, and accountability. As evidenced in Table 1, 85,4 % of the studies analyzed (n=76) focus on operational efficiency, an approach that, while valuable for resource optimization, perpetuates an apolitical narrative that ignores the structural implications of AI in public transportation.[5] This bias is not merely quantitative; it reflects an epistemological orientation that prioritizes quantifiable metrics, such as reduced travel times or costs, over qualitative dynamics of power and exclusion.[6]

First, the hegemonic emphasis on efficiency reveals how AI is positioned as a "neutral" tool for solving complex urban problems, but in reality encodes pre-existing values that favor certain social groups. For example, demand prediction algorithms, such as those proposed by Ye et al.[2], can improve efficiency by 30 % through machine learning, but they are often based on biased historical data that underestimates the need in marginalized neighborhoods, exacerbating spatial inequality.[9] Recent studies confirm this trend: an analysis of Mobility as a Service (MaaS) systems in European cities found that algorithmic optimization reduces equitable access for low-income populations by 15-20 % because it prioritizes high-density routes.[1,7] This dynamic is not accidental; it responds to a techno-economic framework where AI is integrated into ecosystems dominated by

private actors, such as big data companies, which privilege profitability over social justice.[8,10]

Furthermore, the scarcity of research on equity (only 6,7 % of articles) exposes a critical gap in understanding how AI generates new forms of digital exclusion. Emerging literature highlights that AI models in public transportation, by relying on unrepresentative training data, reproduce racial and socioeconomic biases.[3] For example, a study on AI in urban planning in Asia found that route optimization algorithms discriminate against minority communities by underprioritizing stops in peripheral areas, increasing the mobility gap by 25 %.[4,13] This problem is exacerbated in post-pandemic contexts, where the datafication of transportation has intensified surveillance and control, without adequate mechanisms to mitigate ethical risks.[11,12]

In terms of transparency and accountability (5,6 % of studies), the "black box" of proprietary algorithms represents a fundamental challenge to democratic governance. Inherent opacity limits the ability of public authorities to audit algorithmic decisions, weakening decision-making sovereignty.[7] Recent research proposes the use of Explainable AI (XAI) to improve auditability, but its adoption is limited in public transport, with only 10 % of implementations reported in smart cities.[13,14] This contrasts with participatory approaches, which are almost non-existent (2,3 %), where co-creation with citizens could democratize AI, but requires regulatory frameworks that the current literature underestimates.[5,6]

These results imply that algorithmic governance not only optimizes systems, but also reconfigures power relations, often to the detriment of equity. To counteract this, a reorientation toward algorithmic justice is needed, integrating interdisciplinary perspectives that address the trade-offs between efficiency and social values.[1,9]

The reconfiguration of power relations through algorithmic governance is also evident in the integration of AI with platforms such as Mobility as a Service (MaaS), where centralized data and algorithms promise sustainable mobility, but often under the control of private actors.[15] This approach, while efficient in terms of service integration, raises concerns about public data sovereignty, as technology corporations accumulate power through the extraction of urban data, limiting the ability of local governments to intervene in critical decisions.[10,16] In this context, the literature reveals that only a minority of studies (less than 10 %) consider the risks of algorithmic monopolization, perpetuating a cycle where efficiency becomes an end in itself, ignoring distributional impacts.[17]

On the other hand, the social equity challenges identified in our SLR highlight how AI can amplify pre-existing inequalities in urban mobility. For example, in environments where training data reflects historical patterns of exclusion, route optimization algorithms tend to marginalize vulnerable communities, as observed in analyses of Asian and European cities.[13,18] A recent study on the impact of AI on transportation shows that, without inclusive governance frameworks, operational improvements can reduce equitable access by 20 %, disproportionately affecting low-income groups and ethnic minorities.[19] This digital exclusion not only exacerbates the mobility gap, but also undermines public trust in transport systems, fostering social resistance that is underestimated in the mainstream literature.[7,20]

The marginalization of transparency in research (only 5,6 % of articles) points to a systemic problem: the lack of mechanisms to unravel the "black box" of algorithms. Although advances in Explainable AI (XAI) offer potential for improving auditability, their application in public transport remains limited, with successful implementations reported in less than 15 % of urban cases studied.[14,21] This contrasts with the need for accountability, where algorithmic opacity can lead to discriminatory decisions without clear legal responsibility, as in demand prediction scenarios that prioritize profitable areas.[8,22] Our review suggests that this deficiency is not technical, but political, requiring regulatory interventions that integrate citizen participation to mitigate biases.[6]

Finally, the almost absent focus on participatory governance (2,3 %) highlights a gap in the democratization of AI. Emerging studies propose co-design models where citizens contribute to algorithm training, but these are scarce and limited to pilot contexts.[4,23] This omission perpetuates a top-down paradigm, where AI is imposed without consultation, undermining the legitimacy of public decision-making.[1,24]

These research gaps not only limit theoretical progress, but also have practical implications for the implementation of AI in real urban contexts. In cities where algorithmic systems have been adopted for public transport management, such as in smart city projects in Europe and Asia, it has been observed that a lack of transparency generates public mistrust and resistance to adoption.[15] For example, a case study of autonomous bus systems reveals that opacity in decision algorithms can lead to systematic errors, such as underestimating demand in peripheral areas, resulting in an 18 % reduction in service coverage for vulnerable populations. This situation underscores the need to integrate ethical frameworks into algorithmic governance, aligned with principles of distributive justice that prioritize not only efficiency but also social inclusion.[6,13,25]

Additionally, the review highlights how technological solutiosm perpetuates a reactive rather than proactive approach to socio-political challenges. While studies such as those by Ye et al.[2] celebrate advances in machine learning for demand prediction, they ignore how these models, based on biased big data, can reinforce cycles of urban inequality.[13,20] In this regard, the emerging literature on AI in smart cities proposes that governance

should incorporate independent audits to mitigate biases, but only 8 % of the articles reviewed explicitly address this recommendation. This represents a missed opportunity to develop public policies that balance technological innovation with democratic accountability.[7,26]

Finally, the lack of attention to participatory governance suggests a disconnect between academia and the real needs of urban communities. Co-design models, where end users contribute to the refinement of algorithms, could foster more equitable mobility, as evidenced in MaaS pilots that incorporate citizen feedback.[4,27] However, the dominance of the technical paradigm prevents this transition, perpetuating a system where AI primarily serves economic rather than public interests.[5,28]

In summary, the results of this SLR call for a paradigmatic reorientation towards algorithmic governance that integrates ethical and participatory dimensions, ensuring that AI in public transport contributes to sustainable and inclusive urban mobility.[1,9]

CONCLUSIONS

This systematic literature review (SLR) on algorithmic governance in urban mobility reveals that the integration of Artificial Intelligence (AI) in public transport, while promising significant advances in operational efficiency, is marked by a predominant bias toward technological solutionism that marginalizes critical aspects such as equity, transparency, and accountability.[5] The results show that 85,4 % of the studies analyzed prioritize route optimization and cost reduction, as evidenced in studies reporting 30 % improvements in demand prediction through machine learning.[2,28] However, this technical orientation ignores how algorithms encode pre-existing inequalities, generating digital exclusion in vulnerable communities and weakening public sovereignty in decision-making.[6,20]

In conclusion, the opacity of AI models, known as the "black box" problem, combined with limited research on auditing mechanisms (only 5,6 % of articles), poses a risk to the democratic governance of urban transport.[7,14] The literature confirms that, without participatory frameworks, AI can amplify social gaps, reducing equitable access by 15-25 % for low-income populations.[9,13] Therefore, a reorientation towards algorithmic justice is urgently needed, integrating ethical and social perspectives to ensure that urban mobility is not only efficient but also inclusive and sustainable.[1,25]

The limitations of this study include its exclusive focus on English-language academic literature from Scopus and Web of Science, which may omit contributions in other languages or grey sources.[11] Furthermore, the time period (2020-2025) captures an emerging field but excludes pre-pandemic developments that could better contextualize current trends.[12] For future research, an agenda is proposed that focuses on: (1) the development of regulatory frameworks for algorithmic auditing in public transport, incorporating Explainable AI (XAI);[8,27] (2) empirical studies on participatory governance and co-design with citizens to mitigate biases;[4,26] and (3) interdisciplinary analyses that assess the socio-economic impact of AI in diverse global contexts, prioritizing equity in developing cities.[3,24] This academic reorientation is essential to transform algorithmic governance into a tool for social justice in urban mobility.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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