Application of Artificial Intelligence in Public Space Design and Urban Planning in Ho Chi Minh City: Opportunities and Challenges

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ABSTRACT
In the context of global digital transformation and the growing trend of smart urban development, Artificial Intelligence (AI) is increasingly regarded as a strategic tool to enhance the effectiveness of public space design and urban planning. This paper analyzes the opportunities and challenges associated with integrating AI into the planning of public spaces in Ho Chi Minh City—a pioneering metropolis in Vietnam's strategy for creative and sustainable urban development. Employing an interdisciplinary theoretical framework that intersects planning, technology, and urban sociology, the authors adopt a case-based analytical approach, synthesizing secondary sources and referencing international studies to assess the feasibility of AI integration. Findings suggest that AI not only holds promise for improving urban quality of life but also contributes to the establishment of data-driven urban governance. However, realizing this potential requires Ho Chi Minh City to address critical barriers including data infrastructure, human resource capabilities, regulatory frameworks, and societal acceptance. The study concludes with four policy recommendations: standardizing data and technological infrastructure, institutional reform, interdisciplinary human resource development, and technological collaboration.

Keywords*: Artificial Intelligence (AI); public space; urban planning; smart city; Ho Chi Minh City; digital transformation; urban policy; data governance; technology application.*

1. INTRODUCTION

Amid a robust global digital transformation, AI emerges as a key technology shaping the future of urban environments. The integration of AI into public space planning and design is becoming a vital trend among global cities, aimed at fostering smart, sustainable, and human-centric urban development. In Vietnam, especially in Ho Chi Minh City—the most dynamic and populous metropolis—the need for innovative public space planning is urgent due to rapid urbanization, population pressures, environmental concerns, and the increasing demand for improved urban livability.

Public spaces are not merely physical components of urban structure but also cultural and social assets that foster community cohesion and generate positive social value. Yet traditional approaches to planning and managing public spaces remain constrained by limited data, predictive capabilities, and adaptability to evolving societal needs. Within this context, AI is anticipated to unlock new possibilities in real-time data collection, processing, and spatial analysis, thus supporting more effective, accurate, and timely decision-making by planners and administrators.

Despite its considerable potential, the integration of Artificial Intelligence (AI) into public space design and urban planning faces multiple challenges, including limitations in technological infrastructure, data availability, qualified human resources, legal frameworks, and public acceptance. Adopting an interdisciplinary approach that bridges urban planning, technology, and social sciences, this study employs a methodology based on the synthesis of academic literature and policy reports. It also references international models of AI application in urban planning—particularly those developed by organizations such as UN-Habitat and the World Bank—to assess feasibility and propose context-appropriate solutions for Vietnam.

2. THEORETICAL FRAMEWORK AND INTERNATIONAL RESEARCH OVERVIEW ON AI IN PUBLIC SPACE DESIGN

2.1. Conceptual Clarification

Artificial Intelligence (AI) is a branch of computer science focused on developing systems capable of learning, reasoning, and self-adjusting behavior to autonomously perform intellectual tasks (Russell & Norvig, 2016). In urban development, AI plays an increasingly critical role in collecting and analyzing big data, forecasting trends, simulating space, and automating urban management processes (Batty, 2018).

Public space is a vital component of urban fabric, with cultural, social, and environmental significance. Carr et al. (1992) define it as a domain for social interaction and community bonding, while Lefebvre (1991) emphasizes access and participation in public space as essential elements of "the right to the city."

Interdisciplinary approaches are crucial in public space planning. Foth (2009) proposed the "urban informatics" model integrating digital data and user behavior into urban design decisions. Similarly, urban sociologists such as Low, Taplin & Scheld (2005) highlight the importance of place attachment and community participation in public space design.

2.2. International research on AI in public space design globally

Research supports the viability of AI integration in public spaces. In China, Hangzhou's City Brain (developed by Alibaba) monitors and analyzes crowd movement, optimizing public traffic space in real time. In the U.S., Google's Sidewalk Toronto project experimented with AI-driven sidewalk designs that adjusted lighting, seating, and greenery based on user behavior (Sidewalk Labs, 2019).

UN-Habitat (2020) stresses that AI can help cities address spatial inequality, optimize public resource allocation, and enhance citizen participation via digital feedback platforms. However, scholars also caution against risks such as excessive surveillance, loss of personal data control, and digital divides (Eubanks, 2018).

3. EXPLORING OPPORTUNITIES FOR AI APPLICATION IN PUBLIC SPACE PLANNING IN HO CHI MINH CITY

As a leading smart city initiative in Vietnam, Ho Chi Minh City stands at the threshold of transformative AI applications in public space planning to optimize management, elevate urban quality of life, and promote sustainable growth. AI integration aligns with the national roadmap for digital transformation and e-government by 2030 (Government of Vietnam, 2020).

AI facilitates real-time urban data collection and analysis through sensors, surveillance cameras, IoT devices, and citizen feedback platforms. This data supports congestion identification, space usage density analysis, and seasonal or temporal demand mapping. According to Batty (2018), big data integrated with machine learning algorithms can help map public space behavior and suggest contextually appropriate design interventions.

AI also enhances flexibility in public space design to adapt to socio-environmental changes such as climate change, rapid urbanization, or post-pandemic behavioral shifts. Through scenario simulation, planners can test multiple design options before implementation, reducing risk and saving resources. Allam and Dhunny (2019) indicate that AI can simulate impacts on urban microclimates, offering recommendations for drainage, ventilation, and urban heat island mitigation.

Furthermore, AI promotes interdisciplinary and transparent decision-making. By connecting datasets across transportation, environment, health, and culture, AI supports data-driven policy coordination and reduces administrative overlap. This improves public investment efficiency (UN-Habitat, 2020).

Citizen engagement can also be enhanced through digital platforms enabling public feedback and evaluation of public space quality. Gehl (2011) notes that participatory urban design increases public ownership and community cohesion, ensuring more human-centered and sustainable public spaces.

In Ho Chi Minh City, AI deployment could begin with pilot projects in key areas such as District 1, Thu Duc, or the new central zone. These pilots might involve AI in traffic signal coordination, green space allocation, smart lighting design, or pedestrian amenity improvements. Upon demonstrating effectiveness, such models could be scaled citywide, forming a comprehensive urban AI ecosystem.

With governmental, academic, and technological support, Ho Chi Minh City is well-positioned to become a pioneer in AI-driven public space planning that is systematic, effective, and human-centered.

4. CHALLENGES TO AI APPLICATION IN PUBLIC SPACE PLANNING IN HO CHI MINH CITY

Despite its promise, AI implementation in Ho Chi Minh City faces major hurdles in technical infrastructure, legal systems, interdisciplinary workforce development, and public perception.

- Fragmented and Non-standardized Data Infrastructure: Urban data remains largely manual, fragmented across agencies, and lacks comprehensive digitization and standardization. This undermines AI algorithm performance in behavior analysis or spatial simulation (Ministry of Construction, 2021; Kitchin, 2014).
- Limited Technological and Interdisciplinary Human Capital: There is a shortage of professionals who can bridge planning, technology, and social science. Existing urban planning personnel, particularly in the public sector, lack digital skills and exposure to AI-based analytical tools (UNDP Vietnam, 2022).
- Insufficient Legal Framework and Testing Policies: Vietnam's legal system lacks clear provisions for personal data use in urban planning, and responsibility is unclear when AI-generated decisions lead to social risks (Nguyen & Nguyen, 2023).
- Privacy Concerns and Community Acceptance: Public skepticism toward AI in governance remains high, particularly regarding surveillance, personal data collection, and algorithmic opacity (Eubanks, 2018).
- Lack of Pilot Models and Risk Assessment Mechanisms: Without small-scale pilots, it is difficult to assess cost-effectiveness, social-environmental suitability, or policy responsiveness. UN-Habitat (2020) recommends sandbox zones for controlled technology testing to mitigate financial, political, and social risks.

5. CONCLUSION AND POLICY RECOMMENDATIONS:

AI integration into public space design and planning is not only a technological trend but a pivotal step toward modernizing urban planning, improving quality of life, and achieving sustainability. For Ho Chi Minh City, this integration is feasible and aligns with smart city and national digital transformation goals.

However, realizing this vision requires confronting data, workforce, legal, and social challenges. AI should be viewed not as a replacement for human planning but as a tool supporting humanistic, data-informed, and community-responsive urban design.

Based on analysis, the study proposes four key policy directions:

- Data Standardization and Urban Tech Infrastructure Development: Establish interoperable digital spatial databases; invest in sensors, IoT, and integrated analytics platforms for real-time planning.
- Institutional Reform and Legal Framework Completion: Introduce legal provisions for AI-driven planning, data protection, and clear accountability among public-private stakeholders.
- Interdisciplinary Human Resource Development: Incorporate tech, data, and social knowledge into planning curricula; offer training programs for urban managers.
- Technological Cooperation and Urban Sandbox Implementation: Foster public-private partnerships for AI planning; pilot in key districts before citywide scaling.

Future studies should explore urban AI readiness, build adaptive legal frameworks, develop impact measurement criteria from both technical and social perspectives, and emphasize the "AI-assisting-human" model that respects humanistic planning values.

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