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PLANNING AS A TRANSFORMATIVE ACTION IN AN AGE OF PLANETARY CRISIS



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Towards Ethical Implementation of Urban Digital Twins: Addressing Key Challenges and Recommending Best Practices

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Cities are at the forefront of transformative planning in the green and digital era, experimenting with innovative smart city narratives and technologies. This study emerges from embedded research conducted through a collaboration between the **ADAPT Research Ireland Centre**, a national government-funded multi-institutional and interdisciplinary research centre, and Dublin City Council's Smart City Unit under the **Smart Dublin** umbrella (Dhingra and Kerr, 2023). The project aims to trial, test and evaluate Urban (Local) Digital Twin (UDT), bearing **an ethical perspective to inform a digital twin implementation strategy at Ireland's largest local authority** (Dhingra, et.al, 2023).

Authors adopt the EU definition for UDTs as *virtual replicas of physical assets, places and processes –offering evidence-based decision-making capabilities by integrating cross-sectoral, historical, and near-real-time data* (Arriens, 2022). The growing relevance of UDTs is evidenced by the European Commission's report, which identifies 135 UDT platforms across Europe, predominantly at city-level and focussing on urban planning, environment and mobility use-cases (Arriens, 2022). Furthermore, an analysis of Scopus-indexed literature reveals an exponential increase in UDT research, with more than half of the publications emerging in the last two years.

While the role of UDTs is increasingly referred to as crucial for contemporary spatial planning, they may raise many ethical, social and legal issues (Helbing and Argota Sánchez-Vaquerizo, 2022; Wang et al., 2024). Technical barriers, such as achieving interoperable, open-data standards, are further compounded by non-technical hurdles, including capacity building and upskilling of local authority staff, privacy risks, cybersecurity threats, dataveillance, social discrimination, technological lock-ins, and potential democratic backsliding (Weil et al., 2023; Mazzetto, 2024).

This study delves into the ethical challenges associated with UDT implementation for urban decision-making using Dublin as a case study. An extensive literature review, complemented by directly engaging with Irish Local Authority Staff since 2022 through ADAPT collaboration and insights gathered from INTERREG North-West Europe co-funded **Twin4Resilience (T4R) project**, forms the foundation of this analysis. The findings emphasize several key principles to guide the adoption of UDTs by public authorities supporting effective data management, standardization, and operational guidelines for embedding UDTs within existing cultural and institutional frameworks.

Foremost, a **people-first approach** is recommended to ensure that UDTs align with societal goals and public needs. Institutional benefits/impacts must establish their long-term **organizational value**. To address privacy and cybersecurity concerns, **trust in safe data**

handling is paramount. UDTs should avoid any biases and support **non-discrimination and data equity**. Legal and ethical standards require **regulatory compliance** especially to resonate with the current European policy landscape, while user-friendly systems can ensure **accessibility and engagement at every step**. Finally, it is essential to foster **trust in UDTs for decision-making**. The paper concludes with actionable recommendations for facilitating ethical and inclusive UDTs and their potential to bridge socio-spatial inequalities in urban settings.

Keywords:

Urban Digital Twins; People-Centric; Smart Cities; Ethical Implementation

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T_11 EMERGING TECHNOLOGIES / 1144

Motivational Affordances of Gamified Participatory Experiences

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The rapid urbanization of cities brings struggling conditions for both people living in cities and the governments responsible for managing the complex issues of urban areas. Although the adoption of smart infrastructure in cities provides important opportunities for the management of particular systems, collaboration with citizens through these systems is not sufficiently supported. Citizens' concerns and expectations regarding urban issues are not fully understood and their potential contribution is often neglected. Considering the effectiveness of digital participatory tools and environments, it is debatable to what extent the technologies offered contribute to people's motivation to get