Transnational Network of Integrated Planning Labs: co-creating knowledge on forward-looking transdisciplinary planning perspectives addressing climate change and urban life in the post-pandemic city.

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Annotating key concepts of integrated spatial planning

Data-driven planning

Role, limitations and biases of spatial analysis, urban analytics and data in spatial planning

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Mainstream/Conventional Definition

Data-driven planning is conventionally defined as an approach within spatial, urban, and regional planning in which decisions about land use, infrastructure, environmental management, mobility systems, and urban development are substantially informed by the systematic collection, integration, analysis, visualization, modelling, and interpretation of spatial and other urban data. Under this dominant framing, data and analytics are not merely auxiliary tools; they constitute the epistemic backbone of planning processes, providing the empirical evidence required for rational, objective, and methodical decision-making across different sectors and scales.

In mainstream planning discourse, this approach centers on the use of GIS, remote sensing, spatial analysis, urban data science, big data, mobility data, IoT-generated datasets, and demographic or environmental statistics to map, represent, and diagnose urban phenomena in spatially explicit ways. These analytical outputs help planners assess problems, identify trends, forecast future developments, and understand cross-sectoral interactions—such as those between land use, transport, socio-economic conditions, and environmental risks. Through these integrative, data-intensive processes, data-driven planning is presented as a pathway toward more transparent, accountable, and evidence-based interventions, enabling scenario development, impact assessment, and iterative policy evaluation. Ultimately, mainstream definitions depict data-driven planning as a transition from discretionary or intuition-driven practice to a more systematic, analytical, and model-supported mode of urban governance.

Contested Meanings / Debates in the Literature

Debates around data-driven planning revolve around fundamental disagreements about what constitutes valid knowledge in planning, how cities are represented, and who gains or loses power through data infrastructures. While mainstream discourse celebrates data as objective, transparent, and scientifically robust, critical scholars argue that data are always socially constructed, politically situated, and entangled with power. These debates challenge the assumption that data-driven approaches simply "improve" planning; instead, they reveal how data reshape the epistemology, ontology, and governance of urban space.

A core debate concerns the **epistemological status of evidence**. In institutional narratives, data-driven planning is framed as a rational and objective foundation for decisions, with urban analytics enhancing accuracy and predictability. Critical scholarship, however, argues that data privilege what is measurable and suppress what is not, producing a technocratic understanding of the city that marginalizes lived experiences, informality, and qualitative knowledge. Scholars such as Kitchin, Xu, De Albuquerque and De Souza e Silva highlight how quantification introduces epistemic biases, narrowing what counts as legitimate urban knowledge and potentially excluding alternative or situated ways of knowing.

A second major line of critique concerns the **ontology of the city under datafication**. Mainstream practice treats cities as systems that can be represented, optimized, and

predicted through spatial datasets and computational models. Critical authors contest this view by arguing that the city is not merely represented by data but increasingly produced through data practices — what Duarte calls the "city as data." Everyday digital interactions (movement traces, purchases, photos) generate continuous data streams that reshape how urban space is perceived and governed. This ontological shift raises concerns about surveillance, commodification, and the reduction of urban life to extractable digital residues.

Another strong debate focuses on **technocratic rationality, algorithmic governance, and bias**. Proponents claim that algorithms bring objectivity, efficiency, and transparency to planning. Critical perspectives argue the opposite: algorithmic systems embed normative assumptions, encode social biases, and often operate opaquely, thereby undermining democratic deliberation. Planning risks becoming depoliticized — governed not by public dialogue but by predictive models and computational classifications. As Cheng, Bibri, Kitchin, and Xu note, predictive analytics can reproduce inequalities, formalize biased categories, and enact narrow visions of what a "well-functioning" city should be.

Debates also address **spatial data inequality and global disparities**, especially between the Global North and Global South. While open data and platforms like OpenStreetMap are framed as democratizing and universal, critical research shows that global datasets are highly uneven. Large portions of the Global South remain systematically under-mapped or misrepresented, thereby becoming invisible in data-driven analyses and decision-making. De Albuquerque and Herfort et al. demonstrate how data completeness biases create "spatial data injustice," reinforcing unequal geographies of knowledge and limiting the applicability of data-driven methods in marginalized or informal contexts.

Finally, there is a growing debate about **ethics, participation, and alternative futures of data use**. While participatory GIS and citizen-generated data are often celebrated as inclusive, critical scholars argue that these practices can reproduce existing power asymmetries unless governed collaboratively and reflexively. Concepts like "data gardening" (De Albuquerque) propose more emancipatory data practices rooted in co-production, ethics, and local autonomy. Similarly, calls for a "post-digital" turn — articulated by Xu, Duarte, and others — argue that data should be used not only to manage cities but also to imagine more democratic and just urban futures. This perspective reframes data-driven planning as a site of political struggle over whose knowledge, values, and imaginaries shape the urban realm.

Applications in Practice

- **Mobility and Transport Planning**: Big data from GPS, mobile phones, sensors, and public transport systems allow planners to model accessibility, analyze mobility flows, optimize public transport routes, and identify mobility inequities. European surveys indicate that GIS-based models support travel safety analyses, route planning, and transport management—though adoption remains uneven. Advanced analytics and machine learning are increasingly integrated into mobility planning.
- **Evidence-based Policy Making and Strategic Urban Policy Design**: Cross-sectoral spatial datasets are used to support strategic decisions on densification, infrastructure investment, service provision, and regional development. Data-driven

approaches help anchor planning choices in empirical analysis rather than intuition, with recent bibliometric evidence showing expanding institutional interest in "smart urban analytics" for long-term policy design.

- **Participatory Planning and Inclusion (Emerging Practice)**: Citizen-generated data (VGI), crowdsourced mapping, and participatory GIS offer new channels for community input and local knowledge. Although still developing, these practices aim to enhance transparency and foster co-production of planning knowledge. Recent literature on smart urban governance highlights growing interest in integrating participatory data within planning workflows.

Selected References & Key Readings

Batty, M. (2019) "Urban analytics defined," *Environment and Planning B: Urban Analytics and City Science*, 46(3), pp. 403–405. Available at: https://doi.org/10.1177/2399808319839494.

➔ *Provides a foundational, mainstream articulation of urban analytics as a computational and predictive toolkit for understanding cities, while explicitly acknowledging the lack of robust urban theory and warning against data-rich but conceptually thin planning practice*

Kitchin, R., Lauriault, T.P. and McArdle, G. (2015) "Smart cities and the politics of urban data," in *Smart Urbanism*. Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315730554-3/smart-cities-politics-urban-data-rob-kitchin-tracey-lauriault-gavin-mcardle

➔ *A seminal critical intervention showing how urban data, indicators, dashboards, and benchmarks are politically constructed, normatively charged, and constitutive of governance, challenging claims of objectivity in data-driven planning and smart urbanism*

De Albuquerque, J. (2025) "Cities out of data?," *International Journal of Urban and Regional Research*. Available at: https://doi.org/10.56949/2PSOE474.

➔ *Argues that urban analytics systematically reproduce inequality through first-, second-, and third-order data gaps, proposing participatory urban analytics and "data gardening" as a radical alternative to extractive, technocratic data practices.*

Herfort, B. *et al.* (2023) "A spatio-temporal analysis investigating completeness and inequalities of global urban building data in OpenStreetMap," *Nature Communications*, 14(1), p. 3985. https://www.nature.com/articles/s41467-023-39698-6

➔ *Empirically demonstrates profound spatial inequalities in global open data, showing that large shares of the world's urban population remain under-mapped, thereby undermining claims of universality in data-driven planning approaches.*

Closelly Related Concepts

- Justice and the City: Spatial, Climate, and Mobility Justice
- Accessibility and the "15-minute city"