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Smarter, More Inclusive Urban Planning in Data-Scarce Contexts: Lessons from Nicosia

The global discussion around "smart cities" is often dominated by the promise of big data, real-time sensors, and advanced analytics as tools to manage urban complexity. Data-driven urban proposals aim to optimize flows of traffic, energy consumption, housing provision, and public services through the continuous capture and analysis of digital information (Batty, 2013; Townsend, 2013; Kitchin, 2016). Yet, many small or under-resourced cities where such infrastructures are absent, fragmented, or inaccessible fall beyond the reach of this approach. Scholars of digital urbanism have argued that the "datafication" of cities is uneven, producing geographies of privilege and exclusion (Kitchin, 2014; Taylor, 2017). The challenge many under-resourced cities face is not only about expanding data systems but more fundamentally, *how can we still plan effectively when official data is missing or incomplete?* Importantly, this is not only a challenge for the Global South. Across Europe, smaller states and medium-sized cities struggle with similar gaps: fragmented institutional structures, limited investment in data infrastructure, and weak technical capacity. An experience in Cyprus shows how these challenges resonate far beyond the stereotypical smart city narrative, and why alternative models of evidence-based planning are urgently needed.

Cyprus provides a useful example of how data limitations can constrain, but not prevent, meaningful urban planning. The island's planning system operates within a rather fragmented data environment: cadastral and zoning information is held by different ministries, demographic and socio-economic data are often published at coarse resolution, and municipal governments have uneven technical capacity to integrate or analyze them (Ricchiardi et al 2024). Even where data exists, it is frequently difficult to access, reflecting institutional legacies that prioritize administrative control over open availability. This situation is not unique. The European Commission's *INSPIRE Directive* (2007/2/EC) was created precisely to address the lack of interoperability and accessibility of spatial data across member states, yet implementation has been slow and uneven, especially in smaller countries. Scholars of small states have highlighted how limited institutional resources and administrative fragmentation make it difficult to maintain comprehensive data infrastructures. The Cypriot case therefore mirrors conditions found in many medium-sized cities worldwide: although at the margins of the big-data visions of "smart urbanism," these contexts must nonetheless find ways to make evidence-informed decisions about land use, services, and public space.

A research experience in Cyprus, where spatial data is fragmented, official datasets are scarce or hard to access, and institutional capacity to apply Geographic Information Systems (GIS) and spatial analytical models is limited, shows that effective, meaningful, and inclusive planning is still possible. By combining evidence-based design and planning (EBDP) with open-source spatial tools and stakeholder engagement, we have developed a method to guide urban decision-making in data-scarce contexts.

How an EBDP approach fills the data challenges gap

EBDP is defined as a systemic approach that utilizes data, spatial analysis, and scientific evidence, to guide and evaluate urban design and urban development plans (Zhand et al 2024). Its central premise is that planning and design should be guided by tested evidence while remaining open to adaptation and evaluation in practice (Davoudi, 2006). A notable challenge in this approach lies not only in acquiring and defining evidence but in operationalising it: that is, translating theoretical principles into processes that can function under the complex institutional and political constraints of professional practice. To do so effectively, EBDP needs to combine geospatial analysis with expert knowledge and stakeholder perspectives, enabling decision-making that is rigorous but also contextually grounded (Hamilton & Watkins, 2009) as also demonstrated in Figures 1 and 2 by Karimi (2023). This adaptability allows EBDP to operate across different contexts, project types and scales, supporting the iterative refinement of ideas through continuous feedback and evaluation.

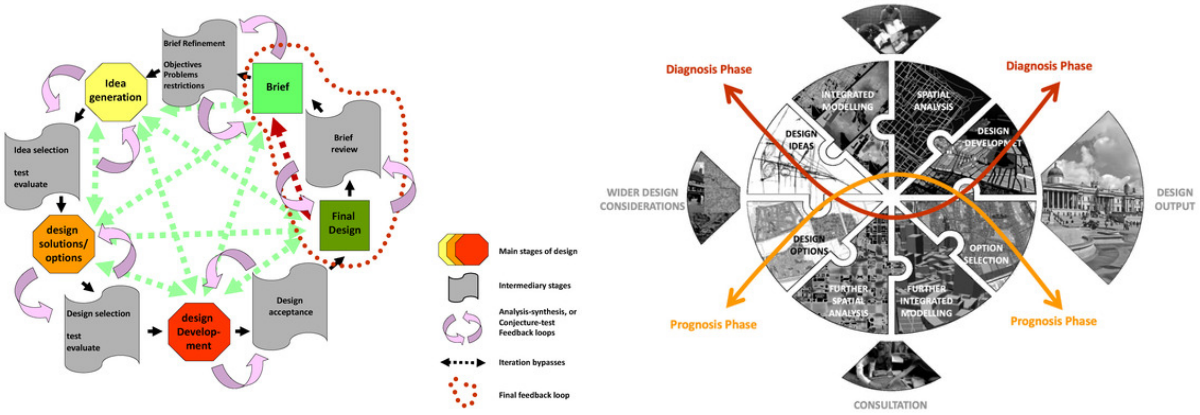

Figure 1 (left) An analytical, evidence-based design process. Each main stage of the design is followed by an intermediary stage, in which some form of analysis/synthesis, or conjecture/test, is applied to assess and evaluate that stage and connect it with the next phase.
Figure 2 (right) The *space syntax* approach follows a process akin to a generic, evidence-based design but places significant emphasis on spatial network analysis and integrated models during the baseline and evaluation phases.

To help cities with less resources implement EBDP, we have developed and tested transferable, hybrid tools and models. Our approach relies on “lightweight” spatial analytical models that draw on open-source data—such as OpenStreetMap—and automate key processes through reproducible workflows in platforms like QGIS and Python (Simons 2025). By minimizing the need for extensive manual editing, these models reduce time demands, lower barriers to entry, and allow municipalities to replicate analyses with limited technical capacity. These models have been validated against models developed using manual techniques, and applied in real-world case studies to answer critical urban questions such as: Where should land uses and services be located to maximize accessibility and ensure equitable distribution? How can green spaces and their amenities be planned to create inclusive and accessible urban nature for all residents? Figure 3 shows the population reach analysis from post offices at a 10Km radius, using the “lightweight” spatial model.

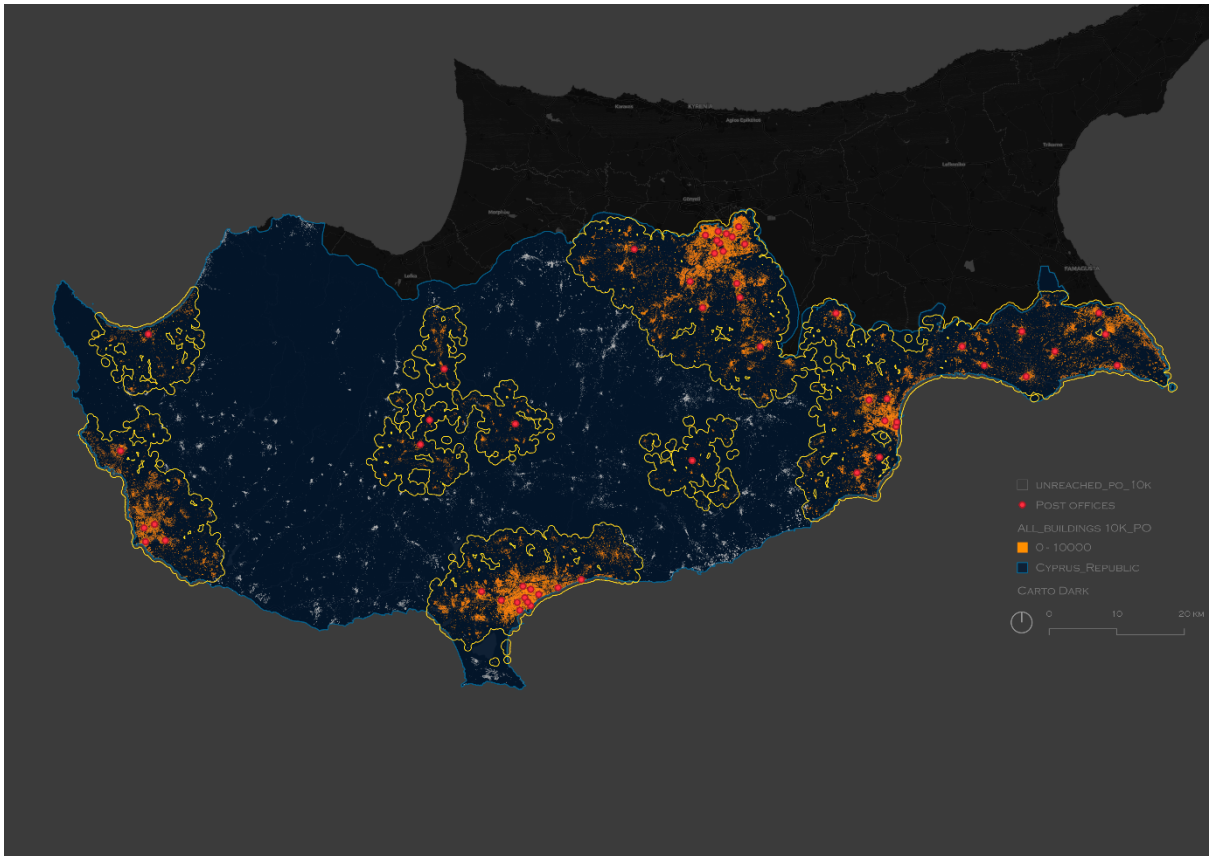

Figure 3 Analysis of population reached by post offices at a 10Km network radius, showing all buildings reached.

A matrix to assess the feasibility of EBDP

Alongside the modelling tools, we have developed an EBDP Applicability Matrix designed to help municipalities and practitioners assess whether an evidence-based approach is feasible before a project begins. The idea builds on the development of evidence-based design, first brought to prominence by Roger Ulrich's seminal study on the impact of hospital environments on patient recovery (Mullins et al., 2015). In the planning and urban design context, feasibility is defined broadly: not only in terms of whether the necessary data and technical competences are available, but also whether there is support from policy frameworks and from the key stakeholders who initiate or oversee projects. The EBDP Applicability Matrix is structured around two guiding dimensions: first, whether stakeholders and policy frameworks support an evidence-based approach; and second, whether the technical capacity exists to develop the necessary spatial models with available data, tools, and expertise. In this way, the matrix provides a straightforward way to test both institutional readiness and technical feasibility before committing to a project.

The matrix can be applied in different ways. Municipalities may use it as part of procurement, requiring project teams to complete the matrix when bidding for an urban study or masterplan, thus allowing proposals to be compared on the strength of their evidence-based capacity. Project teams themselves can also use the matrix as an internal check, systematically assessing potential barriers such as missing datasets, lack of analytical tools, or weak institutional backing.

A way forward for evidence-based planning in any context

The lessons from Nicosia showcase that institutional and/or technical barriers do not have to prevent cities from planning in a rigorous and inclusive way. Open-source tools and lightweight models can

provide practical alternatives to data-intensive systems, offering methods that are scalable and reproducible even for municipalities with limited resources.

Also, the experience highlights that training, institutional support, and stakeholder alignment are as critical as technical capacity. The EBDP Applicability Matrix provides one pathway for cities to reflect on these conditions in advance, ensuring that projects are grounded in both evidence and feasibility.

In conclusion, when combined with stakeholders' input and engagement, evidence-based design and planning strengthens not only the technical quality of urban proposals but also the transparency of decisions and the trust of citizens. Far from being an obstacle, data scarcity can become an opportunity to innovate methods that make planning more adaptive, more transparent, and ultimately more democratic.

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