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SMART CITY DEVELOPMENT IN PRACTICE

Governance, Organizational Design and Strategic Trajectories in Medium-Sized and Central European Cities

THESIS BOOKLET

Summary of the doctoral dissertation

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I. Research background and justification of the topic

1. The research field

Over the past two decades the smart city has moved from a largely technology-oriented discourse to a broader field connecting digitalization, sustainability, urban governance, innovation and quality of life. Early narratives emphasized information and communication technologies, urban data infrastructures and the optimization of city services. A growing body of scholarship has since criticized narrowly techno-centric interpretations and argued for readings that include institutional capacity, citizen engagement, social inclusion and the public value of digital transformation (Hollands, 2008; Kitchin, 2015; Angelidou, 2015; Bibri and Krogstie, 2017). The smart city is therefore not simply a label for advanced technology in urban environments; it is a field of competing visions about how cities should organize innovation, govern transitions and align digital tools with economic, environmental and social objectives.

The central question is no longer whether cities should become "smart" in some generic sense, but under what institutional, strategic and organizational conditions digital urban development produces meaningful and equitable outcomes. This dissertation is situated in that shift. It starts from the observation that the field has produced a large volume of conceptual work, policy discourse, benchmarking exercises and technology-led experimentation, but much less cumulative knowledge about how smart city development is actually organized and governed in specific urban contexts.

Two contextual choices frame the research. First, the dissertation focuses on medium-sized cities, understood in the European context as cities of roughly 100,000 to 500,000 inhabitants (Giffinger et al., 2007), but also, and more substantively, as an implementation setting characterized by thinner administrative and analytical capacity, smaller fiscal room for experimentation, weaker in-house technological expertise and stronger dependence on external funding, suppliers and intermediaries. Much of the influential literature has generalized from capital cities, global cities and flagship projects operating under atypical conditions. Second, the dissertation is anchored in the Central and Eastern European (CEE) context, where smart city development unfolds under post-socialist institutional path-dependencies, comparatively centralized authority, fragmented metropolitan coordination, heavy reliance on EU cohesion and central-government

funding, and a more recent and unevenly embedded uptake of the concept in local strategy (Varró and Bunders, 2020; Varró and Szalai, 2022; Szalai and Fabula, 2021).

2. Research gap

Five interconnected gaps justify the research design. (i) A persistent techno-centric bias: although it is widely acknowledged that smart city development cannot be reduced to ICT deployment, much empirical and policy work still privileges visible technologies over the institutional and social conditions that make interventions effective (Barns, 2018; Ruhlandt, 2018; Sørensen and Torfing, 2018). (ii) The dominance of flagship-city and capital-city perspectives, which distorts understanding of how smart development unfolds under ordinary European conditions. (iii) The limited integration of strategic-management and organizational perspectives — barriers to coordination, resource dependencies, market asymmetries, stakeholder alignment, capability formation — into smart city research. (iv) Limited empirical attention to what cities actually seek to achieve through their activity portfolios, that is, to the anticipated benefits embedded in concrete interventions. (v) A geographical gap: CEE cases remain far less visible than Western and Northern European exemplars.

Read together, these are not five unrelated deficits but facets of one underlying problem: the literature has examined context, barriers, strategy, organization, value and stakeholder relations in isolation, and has rarely integrated them into a single explanatory account of how cities become smart in practice.

3. Conceptual boundaries

The dissertation works with bounded definitions. The smart city is understood as a mode of urban development in which digital technologies, data, organizational capabilities and governance arrangements are mobilized to improve urban performance and public value; smart city development denotes the process through which cities attempt to become smart, rather than a fixed condition. Governance is used more broadly than government, covering the institutionalized processes through which priorities are defined, decisions coordinated, responsibilities allocated and interventions legitimized. Organizational design denotes the configuration of roles, authority, coordination mechanisms, routines and collaborative arrangements through which transition is organized, both inside city

government and across organizations. Four strategic dichotomies structure the comparative language: technology-led versus holistic development; top-down versus bottom-up governance; double-helix versus quadruple-helix collaboration; and mono-dimensional versus integrated intervention logic (Mora et al., 2019; Komninos and Mora, 2018). Finally, activity portfolio denotes the aggregate set of a city's initiatives, value proposition the anticipated public-benefit logic attributed to them, and stakeholder network the relational architecture of smart city governance rather than merely its actor composition.

4. Research question and sub-questions

The overarching research question is: *How do cities, especially medium-sized and Central and Eastern European cities, become smart in practice, and how do strategic orientation, governance arrangements, organizational design and stakeholder configurations shape the translation of smart city ambitions into concrete development portfolios and public-value outcomes?*

The question is pursued through five article-specific sub-questions, each addressing one layer of the integrative framework:

SQ1. What are the principal factors hindering smart city development in European medium-sized cities, and how can these barriers be interpreted through a strategic-management lens?

SQ2. What organizational barriers prevent smart city transition, and what kind of collaborative organizational model can better support urban digitalization under complex, multi-actor conditions?

SQ3. What benefits are anticipated from smart city developments, how are these distributed across cities' activity portfolios, and how can cities be comparatively interpreted on this basis?

SQ4. How can the strategic orientation of a CEE capital city be systematically diagnosed through the four smart city dichotomies, and what does this reveal about the conditions of becoming smart in the Hungarian context?

SQ5. How is the smart city development of a medium-sized Central European city structured in practice, and what do project-level strategic diagnostics and stakeholder-network analysis reveal about its governance model?

The dissertation is article-based for substantive rather than formal reasons: the research problem is cumulative and multidimensional, and no single empirical design could capture barriers, organizational arrangements, strategic value propositions, city-level implementation logics and stakeholder governance structures without sacrificing either depth or comparability.

II. Methods applied

The methodological architecture matches the layered character of the research problem. The dissertation follows a theory-guided, broadly abductive strategy rather than either a purely inductive grounded-theory programme or a strictly hypothetico-deductive one. Empirical material is consistently read through, and used to refine, theoretically derived analytical categories — Porter's Five Forces, the value-proposition components, the four strategic dichotomies — rather than being approached as a blank inductive slate or as a fixed set of variables for confirmatory testing. Within this stance the individual studies sit at different points on the inductive–deductive continuum according to their purpose: the comparative and organizational studies draw on grounded-theory devices such as theoretical sampling (Glaser, 1978) and inductive category development, while the Budapest study formulates and examines explicit propositions once the diagnostic framework is mature enough.

The core is qualitative, interpretive and case-oriented (Yin, 2009), but it incorporates structured coding, descriptive quantification, cluster analysis and network analysis. Data sources include focus groups, expert interviews, literature reviews, strategy documents, municipal repositories, project documentation, digital records and stakeholder project databases; triangulation across source types is used repeatedly to reduce the risk that smart city rhetoric is taken at face value. The five studies also combine different units and scales of analysis: a city segment, an organizational architecture, a multi-city portfolio, a single-city strategic diagnosis and a networked governance structure.

Study	Design, empirical base and analytical role
1 (2018) Barriers in medium-sized cities	Exploratory qualitative inquiry; Porter's Five Forces transferred to the smart city field. Two three-hour focus groups, 15 participants (municipal and public-authority representatives, consultancies, smart city clusters), plus an interview on smaller Romanian settlements; cities characterized by population, GDP per capita, industry tax per capita and higher-education attainment. Role: barrier mapping and problem formulation.
2 (2020) Organizational design in urban digitalization	Multi-phase design research. Extensive literature review with inductive category development; three semi-structured focus groups with city managers, urban planning professionals and technology suppliers to validate and

Study	Design, empirical base and analytical role
	extend the categories; translation of the barriers into a design problem space, resulting in the SmartCEPS platform model, validated in follow-up focus groups. Role: from diagnosis to organizational design.
3 (2021) Value propositions in nine cities	Deductive multiple case study. A literature-derived framework of nine value-proposition components guides the coding of 637 smart city activities in nine cities (six demonstrated and three emerging excellence cases, theoretical sampling). Dichotomous coding per component, plus year, status and outcome attributes; descriptive statistics, cluster analysis and PCA. Role: comparative portfolio layer.
4 (2022) Budapest	Structured single-case study replicating a validated international methodology. Multi-phase data collection from Budapest Portál and the Lechner Knowledge Centre repository, policy documents and local government acts; qualitative content analysis. 111 activities and 337 organizations coded by domain, year, activity type (A–D), spatial level and participating organizations; network visualization in Gephi. Role: operationalization of the dichotomy framework in a CEE capital.
5 (2026) Debrecen	Structured case study extended by stakeholder-network analysis. A validated dataset of 120 initiatives (c. 2007–2025) from municipal project documentation, the official smart city strategy, press releases and stakeholder contributions, each cross-checked against at least two independent sources; coding along the four dichotomies; an undirected collaboration network built from co-participation among 161 organizations. Role: culminating empirical synthesis.

The limits of the design are acknowledged at the integrative level. Several studies rely on non-probability or theoretically selected cases rather than statistically representative sampling, so the portfolio is strong in analytical depth and theory-building potential but weak in statistical generalizability. Structured coding of projects and actors involves interpretive judgement, especially in borderline cases. Documentary and repository-based evidence may over-represent visible, communicable and formally reported projects while under-representing failed, discontinued or informal initiatives. The Debrecen network is constructed from documented project co-participation and therefore captures formalized collaboration rather than informal

influence or political steering. Finally, the dissertation examines the conditions and trajectories of smart city development rather than the measured outcomes of individual interventions, and residents and civic organizations are not directly represented through survey, participatory or ethnographic methods.

III. Scientific results of the dissertation

The integrated answer to the overarching research question is that cities do not become smart primarily by acquiring advanced technologies, adopting the smart city label or accumulating a visible portfolio of digital projects. Smart city development is a context-dependent and governance-mediated transition in which structural conditions, strategic orientation, organizational design and stakeholder configuration jointly shape what kinds of smart urban development become possible in practice. The scientific results are stated below as eight theses.

T1. The barriers to smart city development in medium-sized cities are predominantly non-technological, and a strategic-management lens makes them analytically tractable.

Smart city transition in medium-sized cities is constrained by knowledge deficits among key actors, poor data availability and quality, the absence of robust and widely accepted standards, biased or partial approaches to smart city assessment, and dependence on large external suppliers. These constraints interact rather than operate as isolated bottlenecks: institutional weakness, fragmented knowledge, market asymmetry and strategic ambiguity reinforce one another. Methodologically, the result demonstrates that Porter's Five Forces framework can be transferred productively from enterprise strategy to smart city research — not by treating cities as firms, but by making bargaining positions, market dependency, substitute approaches and structural constraints visible in a field otherwise dominated by normative or descriptive accounts. Medium-sized cities therefore do not begin the smart transition from a neutral baseline; they enter it under asymmetric conditions that shape both what they can do and what models are likely to be imposed on them.

T2. Organizational design is the mediating mechanism between smart city ambition and smart city implementation.

Many recurring problems of urban digitalization are embedded in conventional organizational models themselves. The dissertation systematizes four families of barriers: public-sector barriers (missing coordination mechanisms, authoritative strategic approaches, functional silos, conflicts of interest, power asymmetries, underperforming collaborative design, insufficient collaborative capability, lack of co-initiation, weak innovation capability); private-sector barriers (product focus

over needs, biased assessment, closed innovation, weak alignment between technology supply and urban demand); professional barriers (fragmented knowledge generation, biased interpretation, lack of actionable outputs, treating smart city development as an outcome rather than a planning process); and generic barriers (system complexity, heterogeneous actors, information-flow difficulties, divergent value perspectives and frames of reference). As a constructive response, the dissertation develops and validates the SmartCEPS platform model — a nested structure combining a collaborative urban planning and management layer (city managers, citizens, specialists, consultants, technology suppliers) with a layer for the continuous development of the underlying urban information system by a community of urban professionals. Its value proposition is the translation of divergent frames of reference into a shared, standardized but adaptable urban performance model, lowering transaction costs and improving transparency, coordination and learning. The model is not presented uncritically: it raises data-security requirements, relatively high entry barriers to participation, and a potentially disruptive relationship to conventional deliberative processes — organizational innovation in smart city transition is itself politically and institutionally consequential.

T3. Smart city development is a differentiated public-value trajectory, and activity portfolios are its clearest empirical expression.

Coding 637 smart city activities across nine cities against nine literature-derived value-proposition components — efficiency, citizen (stakeholder) engagement, quality of life, inclusion and equality, connectivity, knowledge creation and sharing, cost reduction, scalability and transferability, and environmental impact — shows that cities do not simply implement more or fewer smart projects; they assemble portfolios with markedly different benefit structures. Cluster analysis identifies four recurring benefit profiles: environmental efficiency, quality-of-life applications, citizen engagement, and social inclusion. The result establishes that the meaning of smartness must be reconstructed empirically from what cities do rather than inferred from how they describe themselves, and it provides an analytical language — value proposition and portfolio logic — for comparing cities without recourse to ranking positions.

T4. A city may combine a broad, multi-domain activity portfolio with a technology-led, partly top-down and double-helix governance

orientation, and with underdeveloped implementation conditions (Budapest).

The Budapest analysis, based on 111 coded development activities and 337 participating organizations, finds a portfolio that is relatively integrated across urban domains but predominantly technology-led, with roughly twice as many technology-oriented as holistic and community-building activities. The collaboration structure is double-helix: government organizations account for 39.5 per cent and industry for 38.9 per cent of participants, while the research sphere reaches 12.2 per cent and civil society only 9.5 per cent. Just as importantly, the framework conditions for implementation — organizational authority, management capacity and cooperation platforms — remain underdeveloped even where visible smart city activity exists. The dissertation-level implication is that a city's smartness cannot be inferred from the existence of projects alone; it must be interpreted through the strategic and governance principles that organize them.

T5. In a medium-sized Central European city, strong municipal orchestration can deliver breadth and implementation coherence while keeping the governance network narrow (Debrecen).

The Debrecen dataset of 120 initiatives implemented between roughly 2007 and 2025 shows a predominantly technology-driven portfolio: 100 initiatives (83 per cent) contain "Services and Applications" or "Digital Infrastructure" elements, against 46 (41 per cent) containing "Community Building" or "Strategic Framework" elements. Governance is overwhelmingly top-down: the municipality participates in 106 of 120 projects (88 per cent), frequently as leading or coordinating entity, often together with its own companies and the city-backed economic development organization. The collaboration network of 161 distinct organizations is heavily skewed toward government and industry actors, confirming a double-helix pattern. The portfolio spans all six standard smart city domains, yet 98 initiatives (81.7 per cent) fall in the Services and Applications category, dominated by buildings and districts (36.7 per cent) and mobility and transport (28.6 per cent); spatially, 61 initiatives (50.8 per cent) are city-level, 45 (37.5 per cent) district-level and 37 (30.8 per cent) building-level, with only one home-level initiative, and 100 of 120 operate at exactly one spatial level. Debrecen thus demonstrates that multi-domain breadth and implementation coherence can coexist with limited participatory depth and weak knowledge-sector inclusion.

T6. Portfolio integration and governance inclusiveness are analytically distinct dimensions of smart city development.

This is the dissertation's central conceptual refinement. The smart city literature sometimes treats integrated development as if it were naturally associated with inclusive governance. The Budapest and Debrecen analyses show that breadth of intervention and breadth of participation do not necessarily move together: a city may be integrated in what it does across domains and projects while remaining selective in who meaningfully participates in governing it. Separating the two dimensions explains why some cities appear strategically coherent while exhibiting narrow actor configurations and municipally dominated governance, and it implies that evaluation frameworks must assess both the coherence of the portfolio and the quality of stakeholder participation.

T7. Medium-sized cities constitute a distinct analytical setting: structurally constrained, but not determined.

The dissertation repositions the medium-sized city from a marginal empirical category to a central analytical setting. Capacity constraints, dependence on external actors, thinner knowledge infrastructures and stronger sensitivity to organizational design are not secondary variables but part of the explanation of which strategic and governance models emerge. At the same time, the first and fifth studies together show that medium-sized status does not determine one fixed outcome: the barrier structure identifies a general risk profile, while Debrecen demonstrates that these risks can be partially overcome under particular governance conditions — though not without trade-offs between central coordination and participatory breadth. Medium-sized cities are therefore not scaled-down versions of smart capitals, and their trajectories depend strongly on how local governance bundles are assembled.

T8. Smart city development can be explained through a six-layer integrative framework linking context to public-value trajectory.

The dissertation's synthesizing contribution is an explanatory chain empirically substantiated across the five studies: (1) the urban context — city size, regional position, institutional environment, resource endowment, data and knowledge capacity — shapes (2) the barriers and enabling conditions of transition; (3) cities respond through a particular strategic orientation along the four dichotomies; (4) that orientation is operationalized

through an organizational and governance design that either supports or hinders collaborative and adaptive implementation; (5) the resulting logic becomes visible in the activity portfolio and the stakeholder network; and (6) these together produce a distinct smart city development trajectory with particular implications for public value, inclusion and urban transformation. The framework integrates a medium-sized-city perspective, an organizational-design perspective, a portfolio-based value perspective, a dichotomy-based strategy perspective and a network-governance perspective that the literature has largely treated separately, and it makes the stakeholder network part of the explanation rather than a descriptive addendum. Applied to the CEE context, it clarifies that smart city development remains shallow where technological modernization is not matched by institutional deepening.

Practical and policy implications

The results imply that smart city development should not be managed primarily as a technology-acquisition agenda. Cities should define smart city ambitions in terms of concrete urban objectives and the public value sought, rather than in terms of technology deployment; build governance models suited to their own capacity instead of adopting scaled-down metropolitan templates; create clear organizational interfaces between strategy, planning, ICT, urban operations and external stakeholder management; treat data and standards as governance infrastructure rather than a technical back-office matter; design stakeholder diversity intentionally, since visible project activity does not by itself produce civic participation or knowledge-sector inclusion; combine strong municipal orchestration with better-designed participatory and knowledge-sharing mechanisms rather than choosing between them; manage interventions as a portfolio rather than as a sequence of independent projects; treat implementation capacity — mandate, continuity, administrative embedding — as a strategic asset; and approach procurement as a strategic governance function in order to avoid vendor-defined development pathways. The most durable smart city investment may not be a specific technology at all, but the city's capacity to govern urban digitalization intelligently and reflexively.

Limitations and future research

The claims are strongest when interpreted as a theory-building, context-sensitive explanation rather than a general theory applicable in identical

form to all cities. The most promising extensions are comparative datasets of medium-sized cities across European regions; longitudinal designs tracing how cities move along the strategic dichotomies over time; outcome-oriented evaluation tracing anticipated value propositions into realized public value; interview-based and process-tracing work on the micro-politics of smart city governance; comparative testing of collaborative platform models such as SmartCEPS; typologies combining portfolio composition with stakeholder-network structure; broader CEE testing beyond Hungary; research on how municipal capabilities are built and institutionalized; and deliberate attention to less visible dimensions — abandoned projects, dormant strategies and informal experimentation — including the residents' and civic perspective that the present evidence base does not directly capture.

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