

COMPARATIVE SMART CITY GOVERNANCE. LESSONS FROM POLAND FOR ADVANCING ROMANIA'S URBAN DIGITAL TRANSFORMATION

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Abstract

The article compares Poland's smart city governance model with Romania's county-capital strategies to identify actionable reforms for Romania's urban digital transformation. Poland embeds smart goals across national and local strategies and tracks progress using indicator-based monitoring, open data, cybersecurity, and inclusion measures. Romania's strategies are ambitious and project-rich but often fragmented, under-specified on outcomes, and light on data governance. Using a four-pillar lens (Economy, Society, Environment, Governance), we benchmark Romanian plans against Poland's indicator set and synthesize common gaps: weak key performance indicator (KPI) systems, limited open data practices, minimal cybersecurity planning, and insufficient institutional capacity. We recommend: a national framework that standardizes pillars and indicators; city data platforms and open-data commitments; cybersecurity by design; indicator-driven management; dedicated smart-governance units and cross-sector coordination; alignment with funding and public-private partnerships (PPPs); and citizen-centric inclusion. This governance-first blueprint preserves local tailoring while enabling measurable progress toward sustainable, inclusive smart cities.

Keywords: smart city governance, digital transformation, smart city strategy, comparative policy, urban development.

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1. Introduction

Cities worldwide are increasingly adopting ‘smart city’ initiatives to tackle complex urban challenges and improve the quality of life through digital innovation (Knight Frank, 2018; Carboni, 2024). A smart city is broadly understood as one that strategically uses information and communication technologies (ICT) and other innovations to enhance urban services, sustainability, and citizen well-being, while engaging stakeholders in governance (Romanelli, 2019). The concept spreads over multiple domains – economy, society, environment, mobility, living, and governance, reflecting the diverse nature of urban development (Kinelski, 2022; Wojewnik-Filipkowska, Gierusz-Matkowska and Krauze-Maślankowska, 2024). Effective governance is crucial in this context: city officials must coordinate across sectors, integrate new technologies, and maintain a clear vision to ensure that smart city projects do not remain isolated but are parts of a coherent long-term strategy (Nam and Pardo, 2011; Meijer and Bolívar, 2015).

In Europe, many countries have developed national or local smart city frameworks to guide urban innovation (Bifulco, Tereguia and Amitrano, 2017). Poland stands out with a comprehensive approach embedded in its urban policy and regional development strategies (Kisała, 2021). Polish cities have embraced smart city principles to focus on economic growth, environmental sustainability, and social needs, supported by national policy documents (e.g., the Strategy for Responsible Development 2020–2030, National Strategy for Regional Development 2030, and National Urban Policy 2023) that emphasize sustainable and inclusive urban development. These policies encourage cities to exploit local potential and find smart solutions, while improving residents’ quality of life and mitigating issues like (uncontrolled) suburbanization. Although there is no single mandated ‘smart city law’ in Poland, many cities/voivodships have adopted smart city strategies or policies aligned with this national vision (Wojewnik-Filipkowska, Gierusz-Matkowska and Krauze-Maślankowska, 2021). Notably, Polish strategies tend to be structured and outcomes-focused, with explicit targets and monitoring indicators across key dimensions (e.g., economic innovation, digital skills, green infrastructure, e-government) to track progress (Kauf, Bruska and Pisz, 2024).

By contrast, Romania only recently began its smart city journey (Vrabie *et al.*, 2013; Stoicescu, Bițoiu and Vrabie, 2023; Romanian Government, 2018). While a growing number of Romanian cities have drafted smart city strategies or implemented pilot projects, the governance of these initiatives, as we will demonstrate, often lacks the integration and strategic continuity seen in Poland. As of today, the responsibility for digital urban innovation rests largely with individual city halls. Many Romanian municipalities have prepared smart city strategies in the last few years, yet their content and quality vary widely. There is a need for a comparative perspective to identify how Romanian cities can improve their smart city governance by learning from more structured models like Poland’s.

Aim and research questions: This article aims to compare the smart city governance approaches of Poland and Romania to derive lessons for policy and practice. The central

question is: How can Romania's national and municipal authorities strengthen smart city strategies and governance, drawing on Poland's strategic framework and best practices? To answer this, we examine: How is Poland's model structured, and why is it effective? What themes and gaps characterize Romanian strategies? How do Romanian plans compare to the Polish development pillars? Which Polish practices are transferable to close Romania's governance gaps? The study contributes to public administration scholarship by highlighting the importance of governance design in smart city initiatives and providing evidence-based policy recommendations for digital urban transformation in emerging smart cities.

The paper is structured as follows: first, a literature review situates smart city governance in the scholarly context and outlines known frameworks and challenges, with a focus on strategic planning, data governance, and stakeholder inclusion. Next, there is the methodology, including the comparative analysis of Polish and Romanian strategy documents and the development of evaluation criteria. The results section presents the Polish smart city governance model and the findings from the Romanian strategies, including comparative tables for each pillar. This is followed by a discussion interpreting the gaps and highlighting best practices from Poland that are replicable. Finally, the conclusion summarizes key insights and offers actionable policy recommendations to advance Romania's smart city governance, as well as broader implications for governing smart cities in the digital age.

2. Literature review

The study of smart city governance has moved beyond cataloguing dimensions or technologies, focusing now on core tensions that shape strategic effectiveness. This review organizes the literature around three key debates: tech-centric vs. citizen-centric governance, KPI-driven vs. narrative evaluation, and projects vs. institutions.

2.1. Tech-centric vs. citizen-centric governance

The smart city concept has evolved through distinctive phases, beginning with technology-led and vendor-driven deployments (Caragliu, Bo and Nijkamp, 2011; Hollands, 2008). Early definitions emphasized digital infrastructure, ICT, and operational efficiency across domains including economy, governance, environment, society, and mobility (Giffinger *et al.*, 2007; Cohen, 2012; Kummitha and Crutzen, 2017). Projects initiated in this era, sometimes termed 'Smart City 1.0', prioritized technological innovation and competitiveness (Kordela and Pettersen-Sobczyk, 2021; Kinelski, 2022). However, critiques quickly emerged, warning that focusing solely on technological solutions risked producing fragmented, unsustainable, or unresponsive outcomes (Trencher, 2019; Vrabie and Dumitrascu, 2018).

These concerns provoked a deliberate turn in both literature and practice toward more inclusive paradigms: 'Smart City 2.0' placed greater agency with public authorities,

steering technology deployment to meet broader development goals; ‘Smart City 3.0’ goes further, highlighting co-creation, community engagement, and the importance of citizen input (Masik, Sagan and Scott, 2021; Vrabie, 2023). This evolution in thinking marks the recognition that the value of smart cities depends as much on participatory governance, stakeholder coordination, and strategic alignment as on the underlying technology (Nam and Pardo, 2011; Meijer and Bolívar, 2015).

Recent qualitative and technology-centric insights into Romanian smart city governance are drawn from the ISEGOV project, a comprehensive study analyzing web-based city governance practices across Romanian municipalities (county capitals are among the municipalities) (Vrabie, 2025). The ISEGOV research offers updated evidence on digital capacities, e-services availability, and citizen engagement mechanisms in Romanian municipalities. This article draws on ISEGOV’s latest data to ground its analysis in the contemporary realities of Romanian local digital governance frameworks, thus complementing international and Polish comparative sources with an in-depth view of the national context.

In both global and comparative contexts (Kinelski, 2022; Wojewnik-Filipkowska, Gierusz-Matkowska and Krauze-Maślankowska, 2024), the debate now centers on how best to balance technical ambition with inclusive, citizen-focused processes. European frameworks (Bifulco, Tereguia and Amitrano, 2017) document how some countries, like Poland, have sought to balance local innovation with national direction, integrating smart city aims not only in technology but in policies for sustainable and inclusive growth (Kisala, 2021).

2.2. KPI-driven vs. narrative approaches to evaluation

As smart city governance matured, measuring progress became central to design and evaluation. The literature identifies two main approaches in this regard: formal, indicator-based monitoring and more qualitative, narrative-driven accounts. Technocratic frameworks prioritize KPIs and targets for cross-domain progress (e.g., economic innovation, digital skills, green infrastructure, e-government), which are routinely embedded in strategies in Poland and benchmarked against national or EU standards (Kauf, Bruska and Pisz, 2024; Campbell and Carayannis, 2009). The logic is that measurable objectives and monitoring indicators anchor accountability and facilitate adaptive management (OECD, 2020; Ranchordás and Klop, 2024; Rathore *et al.*, 2024; OECD, 2023; Mishra *et al.*, 2022).

However, multiple sources highlight that quantitative indicators alone can miss macro-level impacts or public values such as transparency, trust, and inclusiveness (Bee Smart City, 2023; Meijer and Bolívar, 2015; Lember, Brandsen and Tönurist, 2019). Recognizing this, current best practice adds qualitative elements: evaluation dashboards are complemented by participatory tools (Praharaj, Han and Hawken, 2018), narrative accounts of policy learning, and stakeholder feedback mechanisms (Masik, Sagan and Scott, 2021; Praharaj, Han and Hawken, 2018). The scholarship on open data, transparency,

and adaptive governance (ITU, 2023; Jonek-Kowalska and Wolniak, 2024; Lis, Dacko-Pikiewicz and Szczepańska-Woszczyzna, 2022) further demonstrates that a balanced approach, combining KPIs and context-rich evaluation, is critical for resilient smart city development (OECD, 2023; Firszt and Jabłoński, 2023).

Comparative evidence from Poland and Romania underscores how the absence of explicit KPIs and systematic monitoring weakens project coherence and sustainability in less mature contexts (The World Bank, 2020; Vega, 2021; Moldovan, 2025; Decent, 2024).

2.3. Projects vs. institutions: embedding smartness in governance

A recurring challenge is whether smart city advances are realized through discrete projects or by embedding new capacities and values in public institutions (Meijer and Bolívar, 2015; Bifulco, Tereguia and Amitrano, 2017). Project-based approaches catalyze rapid experimentation and visible results, typical in contexts with early or fragmented governance structures (Moldovan, 2025; Vega, 2020; Seemann, 2017). However, without institutionalization, policy frameworks, dedicated units, integrated data platforms, stakeholder councils, such gains are difficult to sustain (Wojewnik-Filipkowska, Gierusz-Matkowska and Krauze-Maślankowska, 2021; Kisała, 2021; Lewandowska *et al.*, 2020; IRMiR and ZMP, 2020; Głębocki, 2024).

National frameworks, such as Poland's National Urban Policy 2023 or Smart City strategies in leading cities (Knight Frank, 2018; Krauze-Maślankowska, 2021), have shown how formalizing smart city objectives within broader urban and regional development enables alignment with funding, resource allocation, and local autonomy (URBACT, 2023). By comparison, Romania's more decentralized and often project-oriented model results in high visibility but low integration, as reflected in the survey of strategy documents and limited institutional adaptation beyond individual initiatives (Boc, 2022; The World Bank, 2020; Stoicescu, Bițoiu and Vrabie, 2023).

2.4. Research questions and evaluation criteria

These debates directly structure our research questions. First, how do Poland and Romania position themselves along the tech-centric/citizen-centric continuum (Caragliu, Bo and Nijkamp, 2011; Giffinger *et al.*, 2007; Nam and Pardo, 2011; Meijer and Bolívar, 2015)? Next, how do their smart city strategies balance KPIs with narrative evaluation and participatory tools (Kauf, Bruska and Pisz, 2024; Ranchordás and Klop, 2024; OECD, 2023; Bee Smart City, 2023)? Finally, to what extent are smart city goals embedded in institutional frameworks versus realized through projects (Meijer and Bolívar, 2015; Wojewnik-Filipkowska, Gierusz-Matkowska and Krauze-Maślankowska, 2021; Kisała, 2021)?

For Polish and Romanian cases, we assess (a) strategic framing, (b) the use of indicators versus qualitative outcomes, (c) the depth of institutionalization, and (d) evidence of participatory and adaptive learning (e.g., open-data, stakeholder committees, public dashboards), referencing each as in the original citations (see summary in Table 1) (Kisała, 2021;

Namysłowska and Olbryk, 2025; Rożałowska, 2021). Limitations in format, monitoring, and institutional design in each country are noted following guidance from comparison studies (Vega, 2020; The World Bank, 2020; Jonek-Kowalska and Kaźmierczak, 2021).

3. Methodology

This study applies a qualitative comparative case study design to analyze the smart city governance frameworks of Poland and Romania (Kinelski, 2022; Caragliu, Bo and Nijkamp, 2011; Vrabie, 2025). The comparative lens is rooted in a four-pillar framework, Economy, Society, Environment, and Governance, drawn from canonical smart city literature and widely adopted in European strategic documents (Giffinger *et al.*, 2007; Kinelski, 2022; Shao and Min, 2025). These pillars align directly with the study's research questions, enabling systematic benchmarking and reflecting areas critical to both technological and governance-centered transformation.

Document Selection: Key policy and strategy documents were collected from both countries using defined inclusion and exclusion criteria. For Poland, sources included national frameworks (e.g., National Urban Policy 2023, Strategy for Responsible Development 2020–2030, National Strategy for Regional Development 2030) and regional/municipal strategies for all 16 voivodeship capitals (Kisała, 2021; Lewandowska *et al.*, 2020). For Romania, the selection encompassed 41 county-capital strategies (including Bucharest) published between 2018–2024, titled as ‘Smart City’, ‘Digital City’, or relevant chapters within Integrated Urban Development Strategies (SIDUs) (Vega, 2020; Vega, 2021; The World Bank, 2020; Vrabie, 2025). Documents had to be: (a) issued or officially endorsed by public authorities, (b) directly address smart city objectives/governance, (c) available in Polish or Romanian, and (d) within the defined time window. Exclusion criteria included draft versions or those not publicly obtainable. All documents were sourced from city hall websites, national portals, or directly from local authorities and were reviewed in their original languages by the authors; analytic synthesis was performed in English.

Coding Protocol and Reliability: The analysis was conducted by systematic content coding combining qualitative and rudimentary quantitative aggregation (counts of themes/indicators). Each document was coded for (a) strategic objectives per pillar, (b) initiatives/projects by pillar, and (c) explicit performance indicators or KPIs. Coding was performed manually by both authors, with a shared codebook created to harmonize definitions and indicator classification (Kinelski, 2022; Shao and Min, 2025). To enhance methodological rigor, a subset of documents (10%) was double-coded; inter-coder reliability was assessed through percent agreement, and discrepancies were resolved via discussion. No automated software was used due to file format and language limitations. Reliability was further reinforced by triangulating extracted themes and indicators against secondary sources, reporting from the World Bank, local government assessments, and prior empirical studies (Vega, 2020; Moldovan, 2025; IRMiR and ZMP, 2020; Vrabie, 2025).

The Romanian dataset used in this article was collected in close coordination with the ISEGOV research team, of which one of the authors serves as the project leader. This alignment ensures methodological consistency with ISEGOV's standardized data collection protocols, encompassing systematic web and document analysis, qualitative coding, and indicator assessment for Romanian county capitals. Employing the same methodology facilitates the validity and comparability of Romanian data within the broader comparative framework of this study (Vrabie, 2025).

Indicator Weighting: Indicators across the four pillars were catalogued and used for benchmarking. Each indicator was treated with equal analytic weight; the purpose was descriptive comparison rather than statistical modeling. However, pillars vary in practical importance for governance: priority is often given to Economy and Governance for policy transfer and institutional adaptation, whereas Society and Environment highlight broader impacts. Where strategies reflected this variability (e.g., indicator targets more common in economy/governance documentation), relative emphasis is noted in interpretation and discussion. Table 2 (Appendix) presents the complete indicator set per pillar, with coverage in both national frameworks and city-level strategies.

Limitations: As the analysis relies on documentary evidence, results reflect the stated ambitions and structures rather than real-world implementation. Further, Romanian documents' heterogeneity (standalone strategies vs. SIDU chapters) limits direct comparison, mitigated by focusing on the presence/absence of core themes and indicators. Poland's synthesized framework incorporates scholarly interpretation to address the absence of a single mandated national monitoring regime (Czochoński, 2013).

4. Results

4.1. Poland's smart city strategic framework

In Poland, smart policies are embedded across national, regional, and local documents that together form an effective governance framework (Namysłowska and Olbryk, 2025).

Integration into development strategies. Smart goals are woven into overarching policies. The Strategy for Responsible Development 2020–2030 and the National Strategy for Regional Development 2030 emphasize innovation and digital transformation for sustainable urban growth, leveraging endogenous potentials (Polish Government, 2023; Polish Government, 2023). The National Urban Policy 2023 similarly promotes quality-of-life improvements through smart solutions and explicitly encourages smart growth paths, providing top-down guidance so cities of all sizes consider 'smart' measures in planning (URBACT, 2023).

Regional and local strategies. Voivodeship-level documents (e.g., Lublin's Regional Urban Policy, with others in Silesia and Łódź) tailor smart concepts to local contexts. Major cities – Warsaw, Gdańsk, Wrocław, Poznań, Kraków – have issued smart/digital strategies typically articulating a vision (e.g., 'comfortable for residents, open for business,

efficient in management through technology’) alongside initiatives (Knight Frank, 2018; Krauze-Maślankowska, 2021).

Pillar-based structure with indicators. The Polish model is known for the use of structured pillars – Economy, Society, Environment, Governance, paired with measurable indicators set for specific regional strategies. The framework’s breadth and measurability enable continuous monitoring. Cities, for instance, might target R&D expenditure as a share of GDP by 2030 or stop brain drain via net migration. Those indicators guide policy and align with EU cohesion metrics, facilitating funding absorption (Kisała, 2021; Namysłowska and Olbryk, 2025).

Data and monitoring infrastructure. Many cities operationalized data platforms or observatories to track indicators. A 2021 survey of 280 municipalities identified ‘evaluation of smart cities’ among six national focus areas, spurring dashboards and open-data practices (Rożałowska, 2021). Gdańsk’s Urban Observatory and Wrocław’s Open-data Portal enable stakeholders to monitor performance. Nationally, Poland advanced from 7th to 3rd place in European open data maturity between 2019 and 2022, showing systematic dataset releases across transport, budget, and environment (ITU, 2023).

Cybersecurity and digital resilience. Cybersecurity is now integral; the National Digital Strategy 2035 includes a ‘Cybersecurity and Digital Defense’ pillar, committing substantial resources to protect critical infrastructure, including approx. 700 million Euro ‘Cyber Shield’ program (Decent, 2024). At the city level, this translates into audits, backup/disaster-recovery plans, and secure-by-design requirements within EU-funded projects.

Institutional and stakeholder coordination. Governance structures frequently involve multi-stakeholder bodies. Many city halls have created Smart City units or appointed a Chief Smart City Officer. For example, Katowice’s Smart City Advisory Committee, by bringing universities, IT firms, and citizen representatives, guides strategies and implementation (Firszt and Jabłoński, 2023). Nationally, the annual Smart City Forum spreads best practices across government and industry (Smart City Forum, 2025).

In summary, Poland’s model is structured and pro-active. National policies provide a framework with pillars and objectives, while regions and cities adjust priorities and monitor progress via indicators. This balanced top-down/bottom-up approach has elevated cities such as Warsaw and Gdańsk in European smart-city rankings, even as adoption remains uneven – smaller municipalities lag behind larger ones, and the national role is primarily enabling (policy, funding, EU cohesion instruments) rather than mandating.

4.2. Romanian smart city strategies: overview

Romania’s landscape differs markedly. By 2024, all 41 county capitals (plus Bucharest, a separate entity) had produced some form of smart city strategy. These emerged in the late 2010s – early 2020s, driven by the Alba-Iulia Smart City 2018 pilot (a nationally recognized pioneer (Seemann, 2017)), the availability of EU funding for urban innovation (notably 2014–2020 and 2021–2027), and mounting pressure on city halls to modernize services.

Typical Romanian strategies include a vision, needs analysis, sectoral initiatives (mobility, safety, education), and occasionally an implementation roadmap, yet quality varies considerably. Some cities (e.g., Cluj-Napoca, Braşov, Sibiu) offer relatively comprehensive documents with objectives and indicators, often shaped by consultancy or EU project frameworks. Others (e.g., smaller cities like Slobozia, Alexandria) offer brief project-list documents with some strategic narrative. Bucharest’s 2018–2019 strategy identified major domains (mobility, e-government), but implementation has been slow and fragmented across its six districts.

Common patterns and issues include a pronounced project orientation. Nearly all strategies cite smart street lighting, smart parking, and CCTV/smart-surveillance as ‘quick wins,’ alongside e-ticketing for public transport, public-space Wi-Fi, digital hubs/innovation centers, and sensor-based waste management. While this aids visibility, it can dilute strategic coherence, yielding lists of initiatives rather than transformative roadmaps.

Most strategies align with standard pillars from (cited) literature, reflecting EU/global frameworks and consultant influence. For example, Braşov structures initiatives under economy, mobility, environment, governance, and living, signaling a multi-dimensional approach. However, depth disparities across pillars are evident. As shown in Table 1, a side-by-side comparison with the Polish framework highlights which focus areas/indicators are commonly addressed in Romanian strategies and where notable gaps exist.

Table 1: Comparative analysis of strategic pillars:
Poland vs. Romanian voivodeship/county capital strategies

Pillar	Indicator	Poland	Romania
Economy	Innovation & R&D (e.g., R&D % GDP, startups, hubs)	Emphasized; targets for R&D, tech clusters; Warsaw plans innovation districts; regions track R&D in GDP.	Partial; many cite ‘innovation hubs’/tech parks (Cluj, Timişoara, Iaşi), but no quantitative R&D targets; focus on facilities over measured outputs.
	Business environment (e.g., GDP/capita, SMEs, Foreign Direct Investment (FDI), employment)	Clear; cities track GDP/capita, FDI presence (e.g., Poznań), SME growth (Łódź), employment, and adult training.	Limited; frequent intent to attract investors/entrepreneurship, few KPIs (exception: Braşov targets IT jobs); economic outcomes rarely quantified.
	Smart mobility (economic aspect) (e.g., logistics, transport efficiency)	Integrated across economy/environment; indicators like airport passengers, public transport usage link mobility to competitiveness.	Strong as projects (ITS, parking apps, e-ticketing) but not tied to economic indicators; mobility treated separately.
	Digital economy & skills	National investment in digital skills (target approx. 80% basic literacy) and city programs for schools/SMEs (ITU, 2023).	Emerging; some digital education/IT-cluster support (Cluj, Iaşi), but no clear skill-level targets; focus often on civil-servant training.
Society	Healthcare & well-being (e.g., life expectancy, doctors/10k, e-health)	Prominent; health indicators embedded; e-health widely used.	Moderate as projects (telemedicine, hospital digitization, e.g., Târgu Mureş smart medical district), but no outcome targets.
	Education & culture (e.g., test scores, preschool enrollment, cultural participation)	Tracks outcomes; invests in smart education and cultural access with attendance metrics.	Qualitative mentions (smart classrooms, digital libraries; Oradea e-learning; digital tourism in Sibiu, Iaşi) without metrics.

Pillar	Indicator	Poland	Romania
	Social inclusion & equity (e.g., poverty risk, elderly services, broadband access)	Includes social metrics and digital inclusion programs; rural–urban equity addressed at policy level (ITU, 2023).	Weak; few explicit equity indicators; some free Wi-Fi/senior assistance; broad ‘digital skills’ references (Bucharest mooted literacy workshops).
	Public engagement (e.g., NGOs per capita, participation mechanisms)	Tracks civic engagement; participatory budgeting common in major cities.	Limited formal tools; occasional ideas (e.g., Timișoara feedback app); few metrics; many strategies developed with minimal co-creation.
Environment	Urban environment quality (e.g., AQI, GHG, green space)	Strong; monitors PM2.5/smog, tracks green space/biodiversity; outcome-focused targets.	Present via tech (air sensors, LED lighting, smart waste; Iași, Bucharest monitoring), but targets (e.g., emissions, park area/resident) are rare.
	Utilities & infrastructure (e.g., wastewater %, water use, energy consumption)	Aligned with EU standards; KPIs for sewerage connection, per-capita water use, renewables; building efficiency, smart grids.	Core project area (smart metering, grids, LEDs). Some qualitative loss/efficiency goals mentioned but not consistently integrated.
	Climate resilience (e.g., flood management, adaptation)	Emerging; adaptation actions (e.g., Kraków IoT flood monitoring; tree indices).	Sparse; only recent mentions (Bacău, Galați), reflecting a gap to be addressed in updates.
Governance	Digital government & services (e.g., e-services, uptake)	High priority; by 2020 approx. ¼ of services online; cities track service counts/usage; integration with national eID.	High in discourse, mixed in practice; ‘virtual city hall,’ ERP/interoperability projects listed, but few usage benchmarks; uptake often low.
	Open data & transparency (e.g., portals, datasets, transparency index)	Emphasized; strong national push; city portals with hundreds of datasets; ‘datasets published’ used as an indicator.	Rarely explicit; few cities mention portals (exception: Cluj-Napoca). The World Bank notes general absence; transparency framed as value, not action plan.
	Institutional capacity (e.g., smart units, staffing, coordination)	Institutionalized roles: 2035 strategy foresees central coordination and ministerial digital offices, cascading to local modernization.	Weak; strategies seldom define administrative changes; ARSC advocates structures, but concrete plans scarce; need for training/new skills recognized without resourcing/timelines.
	Monitoring & evaluation (M&E) (e.g., KPI dashboards, progress reports)	Integrated; defined KPIs; some cities commit to annual public reports.	Largely absent; strategies rarely include monitoring frameworks or KPI tables with baselines/targets – suggesting weak follow-through and ‘one-off’ documents often aimed at funding compliance.

Source: Data compiled by authors from strategy documents and other sources

From Table 1, several patterns emerge:

Project focus vs. outcomes. Romanian smart city strategies are strongly technology- and project-oriented – smart traffic lights, e-governance portals, IoT sensors, yielding tangible improvements. Yet they often lack the outcome-orientation visible in Poland, where targets such as ‘reduce road fatalities by 50% by 2030’ or ‘increase preschool attendance to 95%’ tie technology to societal results. Romanian plans more often state ‘implement an intelligent traffic management system’ without specifying expected reductions in congestion or accidents.

Narrower breadth and pillar imbalance. Economy and mobility dominate (visible investments: smart transport, business hubs). Environmental and social aspects receive less attention (often limited to smart lighting or telemedicine). Governance (open data,

cybersecurity, institutional reform) is the least developed, suggesting an early-stage focus on infrastructure over governance processes.

Gaps in cybersecurity and analytics. Cybersecurity is scarcely mentioned; almost no city strategy addresses securing smart systems or data – assuming national agencies will handle it, a risky assumption. Data analytics/use is also weak: cities plan to collect sensor data, but how it informs decisions or dashboards is unclear. The World Bank’s recommendation that ‘smart city should become an umbrella strategy for municipal development with integrated data use’ underscores this need.

Notable strengths. Strategies are ambitious and future-oriented, focusing on cutting-edge concepts (AI, blockchain). Examples include Sibiu’s exploration of autonomous shuttles and Iași’s proposed ‘smart district’ around a new hospital. Collaboration is rising among local governments (e.g., academic conferences), a change from a decade ago.

Coherence and time-horizon inconsistencies. Without a national template or minimum standards, quality varies by consultant/leadership. Time horizons differ (e.g., Alexandria: 2027, Cluj: 2030), whereas Poland’s timelines more uniformly align with national/EU cycles, easing funding alignment.

Funding and implementation challenges. Many cities struggle to finance and execute plans (Boc, 2022). The Europe of Cities report (Moldovan, 2025) notes that city halls are not well-prepared to use new funding schemes and face difficulties classifying smart investments in local budgets. Some projects proceed via private partnerships, revealing gaps in public-sector initiative.

Concluding, Poland’s framework is structured, data-informed, and institutionalized; Romania’s strategies, while enthusiastic and now widespread, lack comparable structure and governance maturity.

5. Discussion

The comparative results reveal critical differences and improvement areas. We interpret these through administrative, socio-economic, and historical lenses, outline what Romania can learn from Poland, and relate findings to the wider smart city governance literature.

5.1. *From projects to governance*

Poland benefits from a de facto national framework – multiple policies and a planning culture that provides consistent pillars and objectives (Kisala, 2021; Brzeziński and Krystyna-Wyrwicka, 2022). Cities, regardless of size, thus share a common language (sustainable growth, innovation, quality of life, and indicators). Romania lacks a national strategy (The World Bank, 2020; Curtea de Conturi Europeana, 2023), thus fragmentation: some cities prioritize digital tourism, others parking/cameras, with uncertain alignment to national goals. A national vision is important for aligning resources, enabling efficiencies (bulk procurement, standardized data platforms), and synchronizing with EU timelines.

Romania should adopt a National Smart City Framework or guidelines – mirroring Poland’s National Urban Policy, with pillars, recommended indicators, and best-practice processes. Aligning local strategies to national/EU horizons (e.g., 2030) would also improve funding fit. The World Bank recommends making smart city an ‘umbrella strategy’ within city development plans; recent Romanian steps (e.g., establishing a Smart City Committee in 2021 and releasing a Smart City Guide) should be formalized into a coherent framework (The World Bank, 2020).

5.2. From data collection to KPI management

Poland’s indicator-rich, data-driven monitoring reflects a governance culture of evidence and accountability; Romanian strategies seldom include concrete KPIs or M&E plans. Without indicators, cities risk project delivery without success criteria, limiting adaptive management and public accountability (M&E gaps are common in Romanian administration). Capacity constraints (data availability, analytical staff) partly explain this, as does the reluctance to set measurable targets. The rewards are substantial: KPI tracking enables informed policy tweaks and stronger funding cases. Romanian cities should embed a minimal, pillar-based indicator set drawing from Poland’s lists or international standards, and report to a national platform. National agencies could require M&E plans for funding approvals. Poland’s rise in open data maturity shows that political will could lead to rapid progress (ITU, 2023).

5.3. Capacity and security

Romanian strategies frequently overlook ‘governance of governance’: implementation ownership, interdepartmental coordination, and required skills. Poland’s dedicated structures (e.g., ministerial digital transformation offices (Decent, 2024) and city Smart City units) provide continuity across political cycles. Romanian cities need defined roles (CIO/CDO, Smart City Managers, Data Analysts) to integrate systems and sustain operations; otherwise, projects (e.g., smart parking) fade for lack of stewardship (Moldovan, 2025). Municipalities should hire Smart City Offices or Task Forces spanning transport, IT, utilities, finance, and external advisors – mirroring Poland’s stakeholder coordination. Targeted training and peer-learning with Polish cities (open data, EU project management) would accelerate capacity-building.

Poland’s focus on cybersecurity (amid heightened threats) is instructive (Decent, 2024). Romanian strategies’ lack of attention to cybersecurity is risky: vulnerabilities in public Wi-Fi, smart grids, or city databases can erode trust and safety. Local systems require local protocols; assuming national coverage is insufficient. Privacy/ethics (e.g., surveillance vs. rights) also need explicit treatment. Romanian programs should integrate cybersecurity from the outset: audits for new systems, staff training, and cybersecurity initiatives. A city-scale ‘Cyber Shield’, supported by national grants, would parallel Poland’s approach.

5.4. Inclusion and financing

Poland's digital inclusion (web accessibility laws, programs to lift digital skills to 80%) broadens access to smart services (ITU, 2023). Romania's low digital literacy risks underuse of e-services (European Commission, 2022). Citizen engagement tools (e.g., participatory budgeting, hackathons, civic tech) are common in Poland; in Romania, they remain sporadic (e.g., Sibiu/Cluj pilots). Romania should pair technology with education and engagement: digital literacy workshops, open-data hackathons, and accessibility standards (learning from Poland's 2019 Web Accessibility Act) to serve seniors and persons with disabilities (ITU, 2023). Feedback loops (Smart City Councils, town halls) would institutionalize participation, echoing Poland's collaborative ethos (Jonek-Kowalska and Kaźmierczak, 2021).

Execution depends on financing. Poland's stronger economic position and effective absorption of EU funds (Horizon 2020, URBACT, Structural Funds) supported city innovation. Romania, despite eligibility, has underutilized funds due to administrative hurdles. The 2021–2027 budget and Recovery Plan offer major opportunities. A coordinated national program could reward integrated municipal proposals (akin to India's Smart Cities Challenge). PPPs can ease budget pressure when governed to avoid vendor lock-in; Romania should foster broader partnerships (telecoms for 5G testbeds, energy firms for smart grids). Embedding smart projects in strategies ensures eligibility under EU urban axes; the World Bank urges updating SIDUs to make smart city an umbrella strategy (The World Bank, 2020), while city-university-industry consortia can strengthen grant applications.

Smart governance is iterative – Poland's evolving strategies (Responsible Development into Digital Strategy 2035) exemplify adaptability (Winkowska, 2021). Romanian cities should treat strategies as living documents, updating as technologies and needs shift. Positive approaches exist (Alba-Iulia's post-pilot strategy; Cluj-Napoca's refinements), but institutionalization is needed. Annual or biannual progress reviews with public reporting – e.g., a one-page dashboard of projects and indicators – would support learning and accountability, aligning with practices in Western municipalities.

5.5. Why did these differences arise?

Poland's earlier administrative reforms and strategic planning in the 2000s, together with greater decentralization and municipal fiscal autonomy, built capacity and incentives for coherent smart governance. Romanian local governments, though legally autonomous, rely more on central transfers and only normalized long-term strategic planning in the 2010s, often driven by EU conditionalities; many cities are catching up quickly, sometimes pursuing projects to access funds or follow trends. Maturity should grow but it can be accelerated by consciously adopting peer best practices, notably from Poland.

Demography and politics are also important; Poland's urban population (approx. 60%) heightens the salience of city issues, whereas Romania's approx. 56% and historical

emphasis on rural development diluted urban focus (Trading Economics, 2025; National Institute of Statistics, 2024). Romania's recent shift toward cities as growth engines is promising – this special issue of the *Transylvanian Review of Administrative Sciences* signals rising academic and policy attention.

5.6. Positioning Poland as a comparator and considering alternative governance models

This comparative study selects Poland as the benchmark for analyzing smart city governance reforms and practices due to its geographical, historical, and institutional similarities with Romania and its relative advancement in embedding smart goals within multi-level governance frameworks (Kisala, 2021; Lewandowska *et al.*, 2020; Kauf, Bruska and Pisz, 2024). Poland's integration of indicator-based monitoring systems, open-data policies, and cybersecurity measures within national and local urban strategies offers a pertinent case of progress in post-communist digital transformation.

However, Poland is not the sole model of smart governance. Estonia exemplifies an integrated national digital-state platform facilitated by the X-Road interoperability backbone and a universal digital identity system, enabling seamless, secure, and citizen-centric e-services (e-Estonia, 2025; Complex Discovery, 2025). The United Kingdom focuses on service standardization and user experience, driving outcome-oriented governance through the GOV.UK platform and its accompanying comprehensive service standards (Gov.uk, 2025). Denmark's NemID/MitID digital identity system, combined with robust municipal mandates, illustrates a method of embedding digital delivery into law with high citizen compliance and accessibility (IT-Politisk Forening, 2012; Agency for Digital Government, 2018).

Leading cities adopt master plans focusing on vision, priorities, and on how technology serves development goals, with cross-domain coverage and KPIs pillar-based frameworks (Barcelona City Council, 2025; Amsterdam Smart City, 2025; City of Vienna, 2025). Organizing strategies into pillars supports balance; Vienna and Amsterdam align projects to such categories to maintain holistic development, while London and New York illustrate this via open data portals and analytics units (City of London, 2025; NYC Open Data, 2025).

These alternative models highlight that smart governance can follow diverse pathways suited to different political, legal, and institutional contexts.

Importantly, the municipal competencies, fiscal decentralization, and public service delivery responsibilities differ substantively between Poland and Romania, which complicates direct indicator-based benchmarking. Romanian local governments have more limited tax autonomy and less consolidated service roles, potentially explaining some apparent 'underperformance' as differences in institutional design rather than governance quality per se (Boc, 2022; Moldovan, 2025).

Accordingly, while Poland provides a practical and contextually proximate reference for Romania's ongoing digital transformation, this paper advocates for a context-sensitive

interpretation of transferability. Some Polish governance practices may be adapted thoughtfully, while others may require modification or substitution by lessons from alternative models like Estonia's integration or the UK's citizen-centric service design.

5.7. Implications for policy and practice

Technology should be paired with institutional strength, strategy, and measurement; otherwise, pilots risk fizzling out. In emerging economies, the smart-city shift is equally governance innovation and technology; therefore, robust administrative planning would enable effective local integration. Romania can accelerate a sustainable, inclusive digital transformation by adopting structured, data-driven, participatory approaches.

6. Conclusion and recommendations

This comparative study examined how smart city governance is pursued in Poland and Romania, two nations at different stages of urban digital transformation, to distill lessons for advancing Romania's initiatives. Poland's structured approach, integrating smart city goals into national and local strategies with clear pillars and indicators, offers a robust model of digital-age governance. Romanian municipalities, while energetic in crafting strategies and launching pilots, generally lack the strategic coherence, data orientation, and governance mechanisms characteristic of the Polish experience.

Poland's governance is marked by comprehensive planning, stakeholder coordination, and systematic data and monitoring (rich KPIs across the economy, society, environment, and governance). Romanian strategies tend to be project lists with uneven thematic coverage and minimal performance metrics. Critical elements often seen in Poland, such as cybersecurity, open data, and institutional capacity, are absent or underdeveloped in Romanian plans, risking technology deployments without the supporting governance for sustainability and scale. Nonetheless, Romania's movement shows significant strengths: enthusiasm, innovation, and focus on modern solutions. The challenge is to reinforce governance so technological efforts yield durable gains rather than one-off experiments.

6.1. Recommendations for Romania (national and local)

Establish a National Smart City Governance Framework. Create guidance analogous to Poland's integrated policy model, listing pillars, example goals, and suggested indicators, aligned with EU Digital Decade/Green Deal priorities. Standardizing definitions and goals provide a template cities can adapt, rather than reinvent. The framework should also explicitly cover data governance and cybersecurity.

Integrate smart goals into municipal strategies and funding criteria. Update SIDUs to embed smart city advancements (as recommended by the World Bank) and require alignment with local/national frameworks in EU-funded proposals. Linking strategy to investment will convert plans from shelf documents into budget-shaping instruments.

Prioritize data platforms, open data, and cybersecurity. Each city should plan a robust urban data platform (integration hub), an open data program (publishing non-sensitive datasets on transport, budgets, environment), and a cybersecurity plan (risk assessments, staff training, secure-by-design procurement). Poland's rise in open data maturity demonstrates feasibility and benefits. National support (e.g., a municipal 'cybersecurity toolkit' and funding for regional experts) can close current blind spots and protect infrastructure.

Adopt indicator-driven management. Define and track a concise KPI set per city (e.g., e-service availability/usage, commute time, air quality index, share of online budget transactions), with annual public reporting. A national or academic 'Smart City Indicator Handbook,' inspired by Polish practice and international standards, can standardize definitions and data sources. Where data are missing, that signals targeted investments in collection. The aim is evidence-based governance with feedback loops.

Enhance local governance structures and capacity. Create Smart City Governance Units or designate Smart City Coordinators with teams to coordinate across IT, transport, energy, finance, and external partners; track projects; and manage stakeholder engagement. Roll out civil-service training (project management, data analysis, innovative procurement). Facilitate peer learning via city twinning with advanced Polish municipalities and include stakeholder committees (universities, firms, citizen representatives) to mirror Poland's quadruple helix.

Align funding and leverage PPPs. Combine strategic alignment with proactive partnerships to deliver complex projects while avoiding vendor lock-in. Examples include consortia with tech companies and universities for data platforms, or energy-service companies for smart lighting via performance contracts. Consider a national Smart City Challenge Fund – competitive co-financing for strategy-aligned projects to spur innovation and outcome clarity, mirroring successful challenge models.

Foster citizen-centric, inclusive smart cities. Include digital equity commitments so services reach all residents (e.g., helpdesks/mobile units assisting seniors or rural users). Institutionalize engagement – mobile feedback apps, participatory budgeting earmarked for 'smart' ideas, and hackathons using city open data. Accessibility standards should be enforced for city websites/apps, learning from Poland's web accessibility reforms. A people-centered ethos reduces tech-centrism and strengthens legitimacy.

Implementing these steps requires coordination across government levels. Technology diffusion can be rapid, but governance capacity building is gradual – accelerated by learning from peers. Consistent policy support, engaged stakeholders, and disciplined use of data can move 'smart city' from buzzword to operational reality as Poland did. Romania, at a pivotal point in its digital urban development, can fast-track progress by institutionalizing these lessons.

6.2. Contribution and future research

This study underscores the primacy of governance frameworks in smart city development: strategy and mechanisms (as in Poland) correlate with more comprehensive and potentially sustainable initiatives than a less governed approach (as seen in Romania's early stage). Future work could extend the comparison across Central and Eastern Europe (e.g., the Czech Republic), pursue longitudinal assessments in Romania over 5–10 years as implementation data accrue, and compile city-level case studies (e.g., robust open data programs or dedicated smart offices) to complement this macro view.

Last thoughts, governing smart cities requires marrying innovation with good governance. The Poland–Romania comparison shows technology alone does not make a city 'smart'; strategy, institutions, data, cybersecurity, funding alignment, and citizen-centricity do. By adapting proven approaches from peers, Romanian and other cities can better navigate digital transformation toward more livable, sustainable, and inclusive urban futures.

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Appendix

Table 2: Strategic areas and indicators for monitoring the achievement of smart city goals.

Pillar	Indicators
Economy	<ul style="list-style-type: none"> Business entities per 1,000 inhabitants Innovation hubs and startups per 10,000 inhabitants Entities with foreign capital per 10,000 inhabitants GDP per capita Investment outlays in enterprises per capita Manufacturing share in gross value added Municipal employment rate Share of tourists using accommodation Adults (25-64) in education/training R&D expenditure as % of GDP Share of business-sector R&D in total R&D Share of net revenue from high/medium-high tech/digital entrepreneurship Bicycle paths per 10,000 inhabitants Electrified railway lines (% of operational network) Passenger traffic at airports Urban public-transport trips per capita
Society	<ul style="list-style-type: none"> Monthly household expenditure on culture and recreation Participants in sports clubs per 1,000 inhabitants Preschool enrollment (ages 3-6) Theatre and music attendees per 1,000 inhabitants Average life expectancy Nurses per 10,000 inhabitants Physicians per 10,000 inhabitants Road-accident fatalities Foundations/associations/social organizations per 10,000 inhabitants Voter turnout in local elections Beds in hospices/nursing/long-term care per 100,000 inhabitants Employment rate of people with disabilities Households with broadband Internet access (%) Individuals receiving care services per 1,000 people aged 65+ Relative poverty risk rate Residential social-welfare places per 10,000 inhabitants Social-welfare beneficiaries per 10,000 inhabitants
Environment	<ul style="list-style-type: none"> Total capacity of small water-retention facilities Area of public green spaces Electricity from renewables (% of total) Share of legally protected areas Dwellings with basic utilities (%) Electricity consumption per capita Heat-energy sales per residential-building volume Household water consumption per capita Population using the gas network (%) Population using the sewage network (%) Population using wastewater treatment plants (%) Selectively collected municipal waste (% of household municipal waste) Sensor-based waste management

Pillar	Indicators
Governance	Individuals using public-administration services via the Internet (%) Open-data platform per municipality Public Wi-Fi networks per municipality Average annual capital investment expenditures of local governments Average annual own-source revenues of local governments Local-government investment expenditures in total expenditures Own-source municipal budget revenues per capita

Source: Authors' own study with data compiled from cited literature

Table 2.1: Smart city governance-proximal indicators

Pillar	Indicator	Poland	Romania
Governance	Individuals using public-administration services via the Internet	✓	✓
	Open-data platform per municipality	✓	partial
	Public Wi-Fi networks per municipality	✓	partial
	Average annual capital investment expenditures of local governments	✓	partial
	Average annual own-source revenues of local governments	✓	partial
	E-government portal availability and interoperability	✓	partial
	Cybersecurity practices (audits, incident response, secure-by-design)	✓	limited
	Budget transparency (open budgets, participatory budgeting tools)	✓	limited
	Service quality and turnaround times, citizen feedback mechanisms	✓	limited
	Data publication, analytics for adaptive management	✓	partial
	Monitoring & evaluation (KPI dashboards/progress reports)	✓	weak

Source: Authors' own study with data compiled from cited literature

Table 2.2: Context table. Broader socio-economic and environmental indicators

Pillar	Context indicator	Rationale/connection
Economy	Municipal employment rate	Baseline for labor market & digital capacity, not core governance
	Passenger traffic at airports	Proxy for connectivity, supports innovation eco-system
	GDP per capita, investment outlays, share of manufacturing	Economic context for smart city potential
Society	Household expenditure on culture and recreation	Social capital/enabling civic engagement
	Individuals receiving care services	Context for possible digital/telemedicine expansion
	Residential social-welfare places	Background for inclusiveness, not direct governance measure
	Voter turnout, NGOs per capita, foundations	Civic engagement context
	Preschool enrollment, theatre/music attendees	Culture/education context; supports engagement but not governance

Pillar	Context indicator	Rationale/connection
Economy / Society	Business entities, R&D, foreign capital, adult training	Baseline for innovation, digital skills as a precondition
Environment	Share of legally protected areas	Environmental stewardship, not proximate governance
	Urban public-transport trips, green spaces, AQI	Quality of urban context, importance for smart initiatives
	Water/sewage/utilities, sensor-based waste management	Background for infrastructure, some overlap in smart project domain

Source: Authors' own study with data compiled from cited literature