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Public Administration Mechanisms for Smart City Development Based on Digital Interaction Between Authorities and the Public

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ABSTRACT

The relevance of the study stems from the transition of the smart city concept from the technological modernisation of individual services to an integrated model of public administration in which urban data, digital platforms, electronic citizen participation, interoperability and public accountability form a single governance framework. For Ukrainian cities, this issue has practical significance because digital transformation is combined with wartime resilience, infrastructure recovery, high demand for convenient services and the need for transparent interaction with the public. The purpose of the article is to substantiate public administration mechanisms for smart city development based on digital interaction between authorities and the public and to develop an applied model for their implementation in Ukrainian urban communities. The methodology combines systemic, institutional, comparative, logical-analytical, case-based and content-analytical approaches. The source base includes documents of the OECD, UN-Habitat, ITU, UN DESA and the European Data Portal, Ukrainian regulatory and strategic documents on open data, official digital resources of Kyiv, Lviv and Vinnytsia, as well as recent academic works on smart city governance, interoperability, digital participation, open data and inclusion. The article systematises the applied components of smart governance, summarises empirical benchmarks of digital interaction, compares Ukrainian urban cases, proposes an indicator matrix for assessing smart governance maturity, and develops a governance cycle model that integrates data, analytics, citizen participation, decision-making and post-project control. The practical value of the results lies in the possibility of using the proposed model to design municipal digital strategies, service platforms, open data policies, e-democracy tools and smart governance performance monitoring systems.



KEYWORDS

smart city, public administration, digital interaction, open data, interoperability, e-participation, urban services, smart governance.



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Механізми публічного управління розвитком розумних міст на засадах цифрової взаємодії органів влади та громадськості

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СТАТТЯ	АНОТАЦІЯ
Дослідниця DOI: 10.70651/3041-248X/2026.3.20 Отримана: 15.02.2026 р. Прийнята: 19.03.2026 р. Опублікована: 24.03.2026 р. Авторське право © 2026 автора  Цей твір ліцензовано на умовах Ліцензії Creative Commons «Із Зазначенням Авторства – Некомерційна 4.0 Міжнародна» (CC BY-NC 4.0).	Актуальність дослідження зумовлена переходом концепції розумного міста від технологічної модернізації окремих сервісів до інтегрованої моделі публічного управління, у якій міські дані, цифрові платформи, електронна участь громадян, інтероперабельність і підзвітність влади формують єдиний управлінський контур. Для українських міст така проблематика має прикладне значення через поєднання цифрової трансформації, воєнної стійкості, відновлення інфраструктури, високого попиту на зручні сервіси та потреби в прозорій взаємодії з громадськістю. Метою статті є обґрунтування механізмів публічного управління розвитком розумних міст на засадах цифрової взаємодії органів влади та громадськості та розроблення прикладної моделі їх реалізації в українських міських громадах. Методологічну основу становлять системний, інституційний, порівняльний, логіко-аналітичний, кейсовий і контент-аналітичний підходи. Джерельну базу формують документи ОЕСР, UN-Habitat, ITU, UN DESA, European Data Portal, нормативні та стратегічні документи України у сфері відкритих даних, офіційні цифрові ресурси Києва, Львова і Вінниці, а також сучасні академічні праці з проблематики управління розумними містами, інтероперабельності, цифрової участі, відкритих даних та інклюзивності. У статті систематизовано прикладні компоненти розумного врядування, узагальнено емпіричні орієнтири цифрової взаємодії, зіставлено українські міські кейси, запропоновано індикаторну матрицю оцінювання зрілості розумного врядування та модель управлінського циклу, що поєднує дані, аналітику, участь громадян, ухвалення рішень і післяпроектний контроль. Практичне значення результатів полягає в можливості використання запропонованої моделі для проектування міських цифрових стратегій, платформ послуг, політик відкритих даних, інструментів е-демократії та систем моніторингу результативності розумного врядування.



КЛЮЧОВІ СЛОВА

розумне місто, публічне управління, цифрова взаємодія, відкриті дані, інтероперабельність, електронна участь, міські сервіси, розумне врядування.

1. Introduction

The concept of a smart city has undergone a noticeable evolution: from a technology-centered set of solutions related to sensors, applications, urban platforms, and the Internet of Things, to a management model where data, coordination of actors, the quality of digital interaction, and the ability of the authorities to translate information flows into solutions that are understandable to the community become a key resource. The OECD directly links the effectiveness of a smart city with the availability and use of data for the effective provision of public services, but at the same time records the risks of data overload in cities, insufficient capacity to process it, shortage of specialists, financial constraints and security threats [1].

In 2025, UN-Habitat enshrined a human-centered approach to smart cities, according to which digital technologies cannot be an end in themselves, but should be subject to inclusivity, accessibility, human rights protection, transparency, and accountability [2]. The ITU, developing an approach to digital public infrastructure for cities and communities, focuses on interoperability, standards, digital identity, data sharing, cybersecurity, and the reuse of digital solutions [3]. Collectively, these approaches shift the focus from smart cities as a technological shortcut to smart governance as a public administration practice.

For Ukraine, such a change in optics has an independent meaning. The Ukrainian state demonstrates high positions in the field of digital governance: according to UN DESA, in 2024, Ukraine ranked 1st in the world according to the E-Participation Index and 30th place in the E-Government Development Index [4]. At the urban level, however, digital maturity remains uneven. Some communities have developed open data portals, mobile applications, electronic petitions, participatory budgets, and analytical panels; Others are limited to the City Council website, fragmented services, and disparate feedback channels.

The war context has further changed the function of digital urban systems. The city application has ceased to be just a service interface and has acquired the function of a security tool, crisis reporting, mobility support, access to social and veteran services, feedback, and prompt response. This is most noticeably seen in the example of Kyiv, where Kyiv Digital, which started as a smart city initiative, was reoriented to vital communication with residents during the war.

The scientific problem is that in Ukrainian studies and applied documents, a smart city is often described through a list of services, portals, applications, or strategic intentions, but the mechanism of public administration, which combines data, interoperability, digital services, e-participation, accountability, and control into a single cycle, is not sufficiently disclosed. For the article, the applied perspective is fundamental: to identify the components of smart governance and to show how they can be diagnosed, measured and used in the management of Ukrainian urban communities.

2. Literature Review

International documents of recent years form a regulatory and managerial framework in which a smart city is considered as a system for working with city data, services, and stakeholders. The OECD's Smart City Data Governance report shows that the success of smart cities largely depends on the ability of governments to use real urban data to shape policy and provide services, but at the same time highlights the problems of data quality, funding, human resources, legal access and security [1]. UN-Habitat complements this logic with a human rights and human-centered dimension, emphasizing the need for inclusion, accessibility, non-discrimination, and citizen participation in the digital transformation of cities [2]. The ITU translates these principles into the plane of digital public infrastructure, where standards, system interoperability, data exchange, cyber resilience and scalability of urban solutions become key [3].

A separate block of international approaches connects smart cities with the local level of digital governance. UN DESA emphasizes that local authorities are the closest point of contact between citizens and the state, so the gap between national digital services and city portals reduces the overall effectiveness of digital transformation [4]. The European Mission on Climate-Neutral and Smart Cities by 2030 considers cities as laboratories of innovation, which brings together local authorities, citizens, businesses, investors and national authorities [5]. The European initiative Local Digital Twin Toolbox highlights the importance of interoperable digital twins for evidence-based planning, policy testing, and

sustainability support [6]. For Ukrainian cities, these approaches are important because they transfer digitalization from the plane of individual portals to the plane of urban managerial architecture.

The academic literature develops a similar conclusion. J. S. Gracias, G. S. Parnell, E. Specking, E. Paul, and R. Buchanan [7] in a structured literature review show the multidimensionality of smart cities and the impossibility of reducing it to a technological block. J. Grossi and O. Velinder [8] consider smart cities at the intersection of the paradigms of public governance, sustainability, and management of public value. R. Hardy, A. Nurmandi, T. Purwaningsih and G. A. Manaf [9] on the empirical material of Indonesia prove that interoperability significantly strengthens the management of smart cities and the ability of the city to respond to the vulnerabilities of the population. This conclusion is important for Ukraine, where urban information systems often develop as standalone products without sufficient integration between registers, services, analytics and participation channels.

The issue of public participation in smart cities is also shifting from symbolic consultation to active participation in the formation of urban decisions. R. K. R. Kummitha [10] analyzes the modes of active citizen involvement in the management of smart cities and shows that digital platforms have managerial value only when they really redistribute the possibility of influence, and do not play the role of an information showcase. I. Landa Oregi, S. Urrea-Urriarte, I. González Ochoantesana, M. A. Rodríguez, and P. Molina-Costa [11] confirm on the material of two European cases that citizen participation requires a design that takes into account the project life cycle, the availability of tools, the quality of feedback, and the further use of citizens' input in the decision.

At the same time, the critical direction related to digital inequality and inclusion is intensifying. O. Kolotushkina, L. Ripoll González and V. Belabas [12] show that smart cities can deepen inequalities if digital solutions are aimed mainly at technologically competent users and do not take into account age, disability, income level, internet access and digital skills. For Ukrainian communities, this issue is of practical importance, since war, internal displacement, population aging, infrastructure damage, and uneven digital skills form different starting conditions for access to smart services.

Ukrainian literature is gradually moving from general digitalization to the analysis of platform participation, open data, and e-governance in smart cities. I. Dunaev, N. Gavkalova, and O. Kud [13] proposed a platform model of public participation in the concept of smart cities for post-war Ukrainian cities, which directly links digital tools with recovery and urban sustainability. G. Komarnytska [14] considers Smart City in the system of open data and e-government, emphasizing the importance of openness, institutional mechanisms, cybersecurity and data sovereignty. The regulatory framework for this area in Ukraine remains the Resolution of the Cabinet of Ministers of Ukraine No. 835 on data sets to be published in the form of open data [15], and the new strategic framework for the development of open data for 2025-2027. focused on quality, interoperability, metadata, portal accessibility, education and interaction of stakeholders [16].

Despite the availability of these sources, there is a lack of an applied model in the scientific field that combines international standards of smart governance, Ukrainian digital achievements, real urban cases and indicators of managerial maturity. The available works describe open data, digital participation, or the smart city as a concept well, but weakly show how local authorities can translate these components into a diagnostic and management framework.

3. Problem Statement

The article is aimed at substantiating the mechanisms of public management of the development of smart cities on the basis of digital interaction between authorities and the public and developing an applied model for their implementation in Ukrainian urban communities.

To achieve the goal, the following tasks have been set:

- 1) to identify the applied components of smart governance that ensure digital interaction between the government and the public;
- 2) to generalize international approaches to data governance, interoperability, human-centeredness and local digital public infrastructure;
- 3) to systematize empirical guidelines for digital interaction in Ukraine based on open data, e-democracy and urban platforms;
- 4) compare the cases of Kyiv, Lviv and Vinnytsia as different profiles of smart city development;
- 5) propose an indicator matrix and management cycle model suitable for assessing and designing smart governance in Ukrainian urban communities.

4. Methods and Materials

The study is of an applied analytical-synthetic nature and is based on a combination of systemic, institutional, comparative, logical-analytical, case-based and content-analytical approaches. The systems approach is used to consider the smart city as a holistic management circuit that combines data, digital services, interoperability, public participation, feedback and control of results. The institutional approach made it possible to define the roles of the city council, executive bodies, platform administrators, data managers, civil society organizations, businesses, residents and external stakeholders. The comparative approach is used to compare international landmarks and Ukrainian urban practices. The logical-analytical approach was used to build the author's indicator matrix and an applied model of the mechanism of public management of the development of a smart city.

The case approach is applied to three Ukrainian urban examples: Kyiv, Lviv and Vinnytsia. Kyiv is considered as a case of a scalable service platform and crisis digital interaction; Lviv – as a case of open data and the potential of civic technologies; Vinnytsia – as a case of strategic embedding of digitalization in the long-term development of the community. Ukraine in international digital rankings, open data maturity indicators, the number of users and services of Kyiv Digital, E-DEM data, participation budget, the scale of the national open data portal and recorded parameters of urban digital resources.

The source base is formed by documents OECD, UN-Habitat, ITU, UN DESA, European Data Portal, European Commission, Resolution of the Cabinet of Ministers of Ukraine No. 835, materials of the Ministry of Digital Transformation on open data, official resources of Kyiv, Lviv and Vinnytsia, materials of Digital State UA, as well as modern academic works of 2023-2025 on smart city management, interoperability, platform participation, digital inclusion and urban data platforms. All quantitative indicators were used as secondary data from open sources, and the author's coding of cases was carried out on a scale of 0–2. A score of 0 means that the trait is not confirmed by open materials; 1 – the feature is available in fragments, for example, in the form of a separate service, portal, document or non-systemic participation tool; 2 – the feature has an institutionally formalized or scalable character, confirmed by an official resource, a strategic document, regular data updates, a significant number of users or inclusion in the urban management cycle. This approach does not claim to be a complete smart governance index, but ensures the comparability of cases on openly verifiable grounds.

5. Results and Discussion

The first result of the study is to determine that the mechanism of public management of the development of a smart city should be considered not as a list of digital services, but as a system of interrelated management functions. Its core includes data governance, interoperability, service platform, digital citizen participation, analytics for decision-making, security, openness, and post-project control. If one of the components is not developed, the digitalization of the city remains fragmented: services exist separately from data, data – separately from decisions, and citizen participation – separately from the management cycle.

The applied dimension of this problem is clearly visible at the level of empirical guidelines. Ukraine has strong national prerequisites for the development of smart governance: a high level of open data, a significant scale of e-democracy, developed local participation platforms, and the rapid adaptation of digital services to war conditions. At the same time, these achievements are not automatically transferred to each city community. An intermediate level emerges between national digital potential and municipal practice, where human capacity, local political will, data quality, budget, technical standards and real citizen participation become decisive.

The data in Table 1 shows that the basic problem of Ukraine is the different depth of embedding digital tools in municipal administration. High indicators of open data and e-participation create a favorable background, but a smart city arises only when open sets, electronic appeals, applications, service portals, analytical panels and strategic planning are connected in one cycle. Evaluation of smart governance should not be based on the total number of digital products, but on verifiable signs of integration.

Figure 1 captures an important conclusion for the city level: the Ukrainian open data ecosystem has higher indicators in terms of basic dimensions than the EU-27 average in the 2024 report. For the community, the practical task is to transfer this national capacity to the level of specific urban processes:

transport, landscaping, security, housing and communal services, ecology, citizen participation, social support and recovery.

Table 1. Applied empirical guidelines for digital interaction and smart governance in Ukraine

Indicator	Meaning	Managerial interpretation
Open Data Maturity 2024: the general level of Ukraine	97% vs. 83% of the EU-27 average	There is a strong national base for the development of urban open data policies.
Open Data Maturity 2024: Portal / Impact	100% / 100% for Ukraine	Portal and influencer components can be used as a reference point for urban data platforms.
Ukraine in the E-Participation Index 2024	1st place out of 193 countries	E-participation is a strong point of digital governance, but requires municipal operationalization.
Ukraine at EGDI 2024	30th place out of 193 countries	The national digital state creates the prerequisites for local smart solutions.
Unified State Web Portal of Open Data	more than 36 thousand. sets, 11 thousand. managers, up to 9 million users	Open data has a large-scale infrastructure that cities can use for services and analytics.
E-DEM Platform	31,668 resolved Open City appeals; 25,572 petitions; 3,713 consultations; 2,150 supported participatory budget projects	E-democracy already has accumulated applied practices that can be integrated into smart governance.
Kyiv Digital	more than 3.3 million users; 51 services in the city app	A mobile application can simultaneously perform service, information, security, and communication functions.
Kyiv's participation budget	UAH 50 million in 2016; UAH 250 million in 2024	E-participation can move from the consultative level to the allocation of city resources.

Source: Summarized by the author based on [17–20].

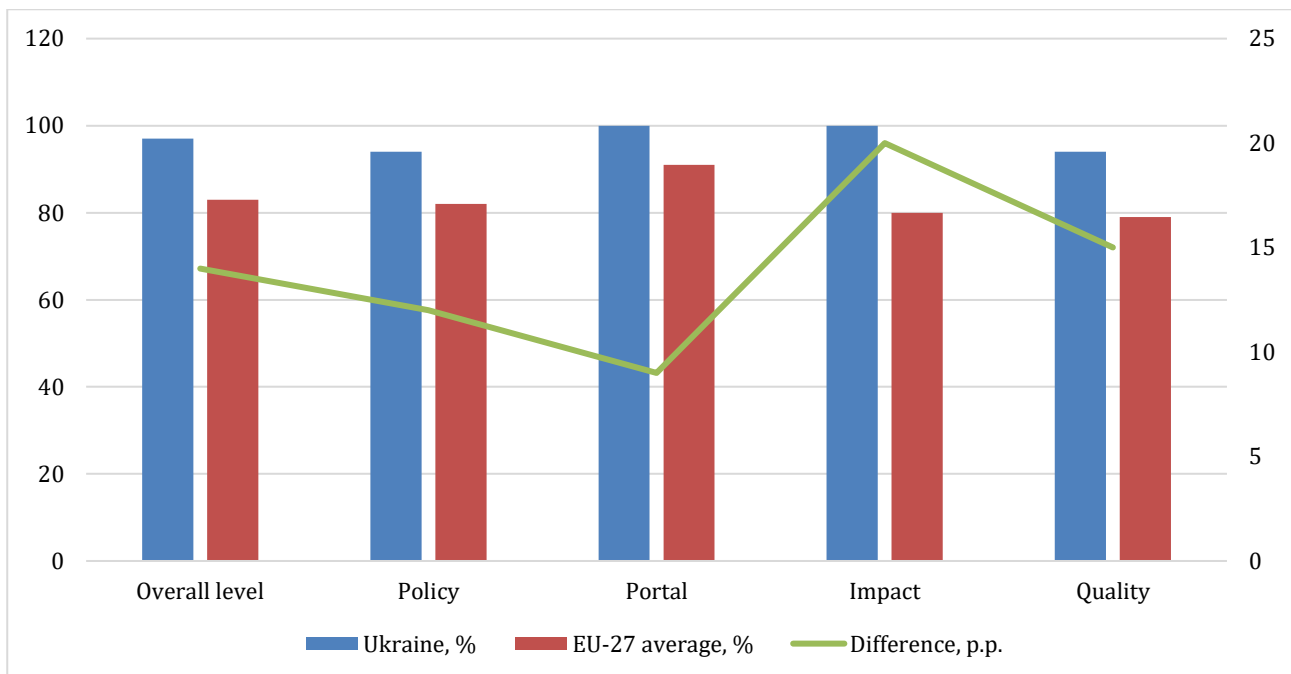


Figure 1. Comparison of Ukraine's open data maturity and the EU-27 average level in 2024, %

Source: Compiled by the author according to the European Data Portal [17].

The second result is related to the comparison of Ukrainian urban cases. Kyiv, Lviv and Vinnytsia demonstrate different profiles of smart city development. Kyiv has the strongest service-mobile and crisis-communication component; Lviv is more clearly represented in the plane of open data; Vinnytsia shows the strategic embedding of digitalization in the long-term development of the community. These cases do not form a simple rating, since each of them demonstrates a different type of managerial maturity.

The Kyiv case shows the advantages of a scalable urban digital platform. The official portal of Kyiv notes that the Kyiv Digital application contains 51 services, including fare payment, parking, car evacuation, transport routes, alarm notifications, power outages and returns [19]. The Future of Government Awards characterizes Kyiv Digital as an application that began as a smart city initiative, and after the start of the war became a vital communication channel for residents and is used by more than 3.3 million residents [20]. The managerial value of the case lies in the combination of daily services, crisis communication, and electronic interaction in one city application.

The Kyiv Service Portal serves as a single point of access to city services for residents and guests of the city [21], and the Kyiv Data Portal accumulates machine-readable official data and analytics generated by structural units of the Kyiv City State Administration, district administrations, utility companies, institutions and organizations [22]. Kyiv is gradually forming a two-layer model of smart governance: a service interface for citizens and a data infrastructure for management analytics.

The Lviv case has another strong point – open data and the potential for reuse of information by public initiatives, media, business, and researchers. The presence of a separate open data portal of Lviv [23] makes the city an illustrative example of data-oriented digital interaction based on access to city information. In this format, the public gets the opportunity to independently analyze urban processes, build solutions for civic technologies, compare indicators, and control the authorities.

Vinnytsia demonstrates a strategic type of digital development. The Development Strategy of the Vinnytsia City Territorial Community until 2030 was approved by the decision of the City Council of February 26, 2021 No. 194 [24]. The Program of Informatization and Digital Transformation of the Vinnytsia Community directly connects digitalization with the implementation of the strategic priority Digitalization of Municipal Space, which aims to increase the efficiency and accessibility of municipal services, the quality of management and public participation through digital, innovative and intelligent technologies [25]. Therefore, the strength of Vinnytsia lies not in the scale of a separate application, but in the presence of a strategic channel through which a smart approach can be embedded in long-term management priorities.

Table 2. Applied profiles of digital interaction in the cases of Kyiv, Lviv and Vinnytsia

Urban community	Strong digital component	Examples of implementation	Management conclusion
Kyiv	Mobile application, service portal, data portal, crisis alerts, e-petitions and analytical panels	Kyiv Digital; Kyiv Service Portal; Kyiv Data Portal; Participatory budget	The most pronounced service and communication profile of smart governance.
Lviv	Open data and the potential for reuse of urban information	Lviv Open Data Portal; local datasets; the potential of citizen technologies	An indicative data-oriented profile that needs to be strengthened in connection with services and participation.
Vinnytsia	Strategic consolidation of digitalization in community development	Strategy 3.0; Informatization and Digital Transformation Program	A strong strategic profile that needs to be operationalized through indicators, platforms, and open results.

Source: Compiled by the author on the basis of [19–25].

Comparison in Table 2 shows that Ukrainian cities should not copy one universal smart city model. A more productive approach is the profile approach: the city determines which component is already strong, which remains fragmented, and which needs institutional launch. For Kyiv, such a task is to deepen the integration between mobile service, open data and citizen participation; for Lviv – the transfer of open data into broader service and analytical solutions; for Vinnytsia, it is the transformation of strategic digitalization into a set of measurable services, platforms, and performance indicators.

Figure 2 shows that digital interaction is cyclical, not linear in nature. Data does not end with publication on the portal, but turns into analytics; analytics should be open for consultation and participation; participation should influence the management decision; the solution should be implemented through a service or project; the result should be returned to the public space through monitoring, audit and feedback. In the absence of such a cycle, even high-quality digital products do not create a full-fledged one smart governance.

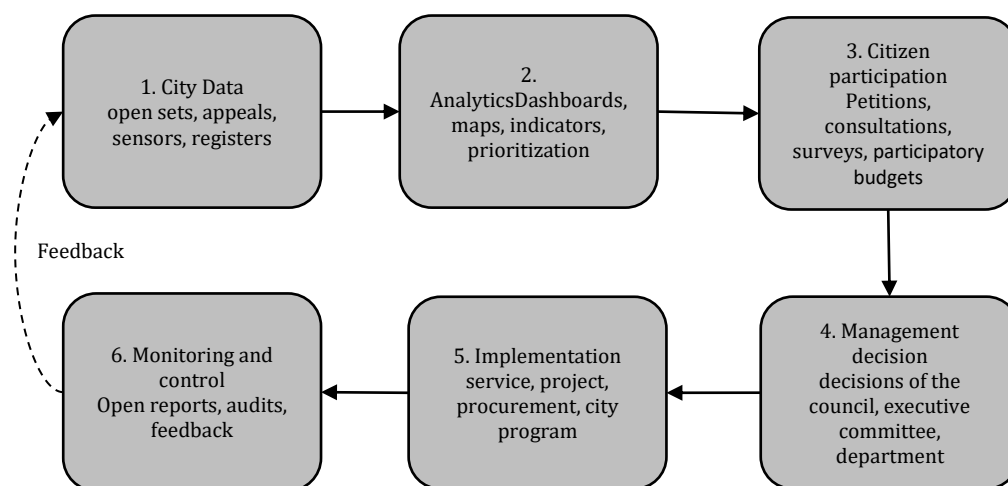


Figure 2. Applied cycle of digital interaction between authorities and the public in a smart city

Source: Compiled by the author.

The third result of the study is the formation of an indicator approach to assessing the maturity of smart governance. For the applied article, it is important not to limit ourselves to a general statement about open data, interoperability and participation, but to show what signs can be tested in a particular community. The proposed matrix does not claim to be a full statistical validation, but creates a working tool for the initial diagnosis of urban digital governance.

Table 3. Indicator matrix for assessing the maturity of smart governance in the urban community

Component	Application indicators	Source of verification	Sign of maturity
Data governance	Quantity and quality of sets; updateability; machine readability; metadata; API	Open Data Portal, regulations, technical documentation	Data is used for solutions, services, and external analysis.
Interoperability	Communication of registers, services, maps, appeals and analytical panels	IT Systems Architecture, APIs, Integrations, Standards	The systems do not duplicate each other, but exchange data.
Service interaction	Single access point; mobile application; online status of applications; Availability of services	Services portal, application, administrative statistics	A citizen sees the full route of the service and receives the result online.
Digital Participation	E-petitions; consultations; surveys; participation budget; Feedback	E-democracy platforms, council website, E-DEM	Participation affects the agenda and allocation of resources.
Accountability	Public dashboards; performance reports; data on appeals; Public KPIs	Data portal, departmental reports, city programs	The public can trace the path from problem to solution.
Sustainability and safety	Crisis alerts; cyber protection; reservation; Protection of personal data	Cybersecurity documents, application, crisis protocols	The digital system works not only in normal, but also in crisis conditions.

Source: Developed by the author on the basis of [1–6; 9–14; 19–25].

To test the indicator logic, the initial author's coding of three cases in six dimensions was carried out. The scale is of an applied nature: 0 – the feature is not confirmed by open materials; 1 – the feature is present in fragments; 2 – the feature has a formalized, scalable or strategically fixed character. Such coding does not replace a full audit of the city's digital policy, but allows you to quickly determine the profile of the community's strengths and weaknesses.

Table 4 paffirms the different nature of digital maturity in Ukrainian cities. Kyiv has the strongest profile in terms of service, participation, sustainability and control, but for a complete model to need to be further linked to service data with long-term strategic indicators. Lviv demonstrates strong open data potential, but the application effect depends on the extent to which datasets will be transformed into services, consultations, city dashboards and solutions. Vinnytsia has a strategic framework

digitalization, but its managerial value will grow under the condition of open operationalization through data sets, digital services, public KPIs and regular monitoring.

Table 4. Primary coding of smart governance profiles in three Ukrainian urban cases

Criterion	Kyiv	Lviv	Vinnytsia	Explanation
Open Data & Analytics	2	2	1	Kyiv and Lviv have distinct data portals; in Vinnytsia, the strategic, not the portal level is stronger.
Single service platform / application	2	1	1	Kyiv Digital and the Service Portal form a scalable service profile.
Digital citizen participation	2	1	1	Kyiv has a stronger connection of e-petitions, participatory budget, and the city app.
Strategic integration of a smart approach	1	1	2	Vinnytsia has a clear strategic consolidation of the digitalization of municipal space.
Crisis resilience and security communication	2	1	1	Kyiv Digital has been adapted to the functions of military information and critical notifications.
Public control and feedback	2	1	1	The Kyiv Data Portal contains dashboards and sets for appeals and petitions; Other cases need more complete integration.
Total profile	11/12	7/12	7/12	The assessment does not show the city's quality rating, but the profile of managerial maturity on open grounds.

Source: Author's coding based on [19–25].

The fourth result is the development of an applied mechanism for public management of the development of a smart city. It is advisable to build it from a managerial task, not from technology. If a city starts by purchasing an app or platform without defining the problem, responsible actors, data, metrics, participation channel, and control procedure, it gets a digital product without a sustainable management function. If the starting point is a management problem, then technology is selected as a means of solving it.

Table 5. Step-by-step mechanism of public management of smart city development

Stage	Content of the action	Responsible entities	Applied result
1. Diagnosis of an urban problem	Definition of the problem, user groups, territory, risks and expected effect	Profile Department, Analytical Unit, Public	Passport for the digital management task.
2. Data Inventory	Determination of available sets, sources, quality, legal regime and possibility of opening	Data Stewards, IT Department, Legal Service	Data map and gaps to collect.
3. Design of a service or platform	Digital Tool Selection, User Scenarios, Integrations, Security, Accessibility	City Government, IT Contractor, User Groups	Terms of reference with interoperability requirements.
4. Digital Participation	E-consultations, surveys, petitions, testing of the service, collection of proposals	Public, OSN, public organizations, business	The contribution of citizens to the design of the solution is recorded.
5. Launch and execution	Service implementation, staff training, communication with users	Executive bodies, platform administrator	Functional service or digital channel.
6. Monitoring and correction	Public KPIs, data audit, analysis of requests, process review	City Council, control bodies, public	Performance report and revision plan.

Source: Developed by the author.

The proposed model in Figure 3. It shows that digital interaction between the government and the public is not a separate function of the communications department. It arises at the intersection of data, services, participation, security, analytics, policy implementation and accountability. In such a model, the public not only receives a message or a service, but becomes a data source, a participant in prioritization, a user of the service and a subject of control of the result.

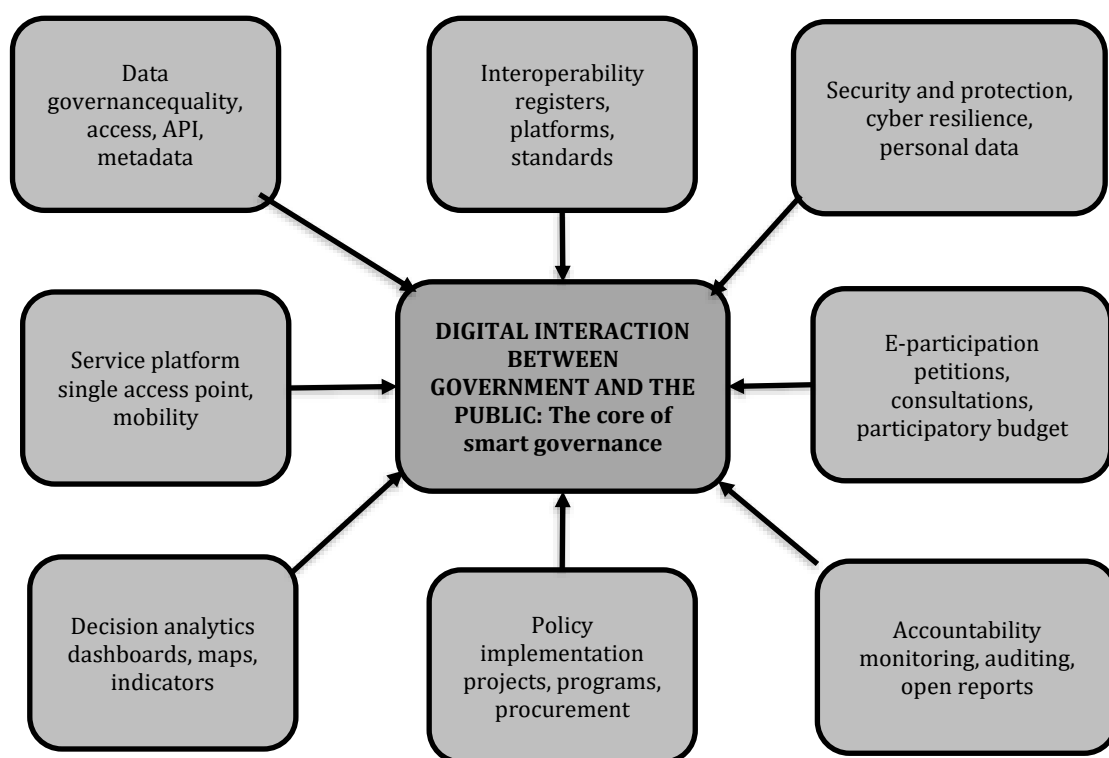


Figure 3. Integrated model of the mechanism of public management of smart city development

Source: Compiled by the author.

The proposed model has practical value as a tool for urban digital strategies. It shows that the digital interaction between government and the public is formed at the intersection of data, services, participation, security, analytics, policy implementation and accountability. In this model, the public acts as a data source, a participant in prioritization, a user of the service and a subject of control over the result.

The fifth result concerns the limits of adaptation of international models to Ukrainian conditions. European approaches to local digital twins, urban data spaces, and climate-neutral smart cities are useful for Ukraine, but they cannot be transferred mechanically. Ukrainian communities are working in conditions of war, budget constraints, infrastructure damage, internal migration, uneven digital capacity, and increased cyber risks. Therefore, the priority should not be the demonstrative complexity of technologies, but basic manageability: open data, service usability, crisis communication, inclusiveness, integration with reconstruction, and transparent control of resource use.

In the applied dimension, it is advisable to distinguish three levels of smart city development. The first level is basic digital accessibility: website, electronic appeals, open data, public contacts, and online services. The second level is integrated service: a single portal or application, application statuses, data integration, regular dashboards, and electronic participation. The third level is smart governance: data is used for forecasting, prioritization, budgeting, monitoring, citizen participation, and post-project evaluation. Most Ukrainian communities are between the first and second levels; Individual large cities form elements of the third level, but their sustainability depends on institutional consolidation, budget, personnel and data standards.

Risks should be recorded separately. A smart city can increase transparency and engagement, but it can also create new inequalities if digital tools are not available to the elderly, people with disabilities, internally displaced persons, residents of peripheral areas, or users with low digital skills [12]. A smart city can increase efficiency and, at the same time, increase dependence on contractors, closed platforms and opaque technical solutions. It can accumulate large amounts of data, but without proper protection and access rules, this data turns into a source of risk. Therefore, digital interaction must be accompanied by legal, organizational, technical and ethical safeguards.

Taking into account the analysis, it is advisable to define the mechanism of public management of smart city development as a system of legal, organizational, digital, analytical and communication tools through which local governments ensure the collection and disclosure of urban data, the provision of

digital services, public involvement in the preparation of decisions, the integration of information systems, monitoring the implementation and public accountability of results. Its effectiveness depends on the quality of the connection between the technology and the power decision: a digital tool should not be an appendix to management, but an element of a full cycle from problem to result.

6. Conclusions

It has been established that it is advisable to consider a modern smart city as a model of public administration, and not as a set of technological solutions. Its effectiveness is determined not by the number of applications, sensors, or portals, but by the quality of data governance integration, interoperability, digital services, e-citizen participation, analytics, security and accountability. The international approaches of OECD, UN-Habitat, ITU, UN DESA and the European Commission are summarized, which confirm the transition from a technocentric model to human-centric and data-centric governance. For Ukraine, these approaches are important given the high national digital capacity, but uneven municipal implementation. The Open Data Maturity, E-Participation Index, the scale of E-DEM, the development of Kyiv Digital and city portals demonstrate the availability of a base for the development of smart cities, but the key task remains the transformation of digital tools into a full management cycle.

Based on the cases of Kyiv, Lviv and Vinnytsia, three different profiles of smart governance have been identified: Kyiv demonstrates a scalable service-communication and crisis-resilient profile; Lviv – a data-oriented profile related to open data and the possibility of its reuse; Vinnytsia – a strategic profile where digitalization is enshrined in the long-term development of the community of Ukrainian cities instead of copying the universal model. An indicator matrix for assessing the maturity of smart governance is proposed, which covers data governance, interoperability, service interaction, digital participation, accountability, resilience and security. The matrix can be used for the initial audit of urban digital policy, the preparation of strategies, informatization programs, terms of reference for digital services and the performance monitoring system. digital services, the quality of urban data, real participation of citizens, the managerial use of analytics and post-project control.

An applied model of the mechanism of public management of the development of a smart city has been developed, in which digital interaction between authorities and the public is the core of smart governance. The model provides for a cyclical movement from urban data to analytics, public participation, management decision-making, implementation, monitoring and correction. It is advisable to use it as a diagnostic framework that allows you to determine the current profile of the city's digital maturity, identify weak links between data, services and citizen participation, and choose priorities for further digital policy.

Further research should be directed to building a full-fledged smart governance index for Ukrainian communities, empirical testing of the indicator matrix on a wider sample of cities, assessing the impact of digital services on trust in local authorities, as well as analyzing the role of smart city systems in infrastructure restoration, increasing resilience and managing crisis risks.

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