DOI: 10.63550/ICEIP.2025.67.91.083

Typology of Mechanisms of Smart Cities Public Administration

Konstantin Semyachkov[a]
Ural Institute of Management of the Russian Presidential Academy of National Economy and Public Administration, 8 Marta Street, Yekaterinburg, Russia
k.semyachkov@mail.ru

Keywords: Smart city, digitalization, mechanism, public administration, urbanization

Abstract: Digitalization processes have a significant impact on the development of modern cities. Innovations in the digital environment are considered as a tool for solving problems in modern cities. New models of urban areas are created on the basis of digital solutions, the strategy for the formation and development of smart cities is implemented. The theoretical and methodological apparatus of economic science was unable to offer adequate tools for studying smart cities and public management of their development processes. In this regard, issues related to the development of management tools in the field of digitalization of urban areas are becoming relevant. The study developed a typology of urban territory management mechanisms based on the digitalization criterion. The study presents the functions of the public management mechanism of a smart city, substantiates its participatory nature.

[a] https://orcid.org/0000-0003-0998-0183

DOI: 10.63550/ICEIP.2025.67.91.083

1 INTRODUCTION

As digitalization ideas are increasingly being implemented in various areas of society and used to develop modern cities, there is an increasing need to study the processes within which smart cities are created, and the development of territories based on innovations in the field of digitalization is intensifying.

Digitalization processes have a significant impact on the development of modern cities. Innovations in the digital environment are considered as a tool for solving problems in modern cities. New models of urban areas are created on the basis of digital solutions, and a strategy for the formation and development of smart cities is implemented. It is important to note that smart city innovations are ultimately a tool for public administration and act as a superstructure for local government. Therefore, advanced forms of local government in a smart city form an ecosystem that determines the living conditions of the local population.

In this regard, issues related to the development of management tools in the field of digitalization of urban areas, improvement of mechanisms for managing cities, taking into account the balance of interests of the main parties involved in the development of the city ecosystem, are becoming relevant, which requires the development of new approaches to city management, the creation of combined mechanisms for managing urbanized areas.

Industrial city. Industrial cities are the basis for the formation of infrastructure for the digitalization of the urban environment. This is due to the fact that, based on the infrastructure existing within such economies, digital technologies will be introduced into various spheres of the economic life of the urban system in the future.

Information city. The third scientific and technological revolution created the conditions for the transition to a post-industrial society, and the main factors in the development of society were science in general and computer science in particular, as well as the growth of the service industry. As a result of the development of the information city, an information environment and Internet space were formed, and many functions of the urban system were transferred to the virtual environment. The main idea of this stage was the visualization and implementation of virtual representations of physical objects of the urban economy.

Digital city. A new stage in the development of information and communication technologies, an increase in the capacity of communication systems and the development of software products have significantly changed the role of information in the functioning of cities. The increase in the amount of data circulating in the information space contributed to the formation of a new development paradigm. Such data in digital form began to be considered a resource for socio-economic development. Digital data have become the subject of economic relations. This type of city largely imitates the basic concept of a city as a social space of cooperation.

Smart city. The development of modern cities based on the introduction of intelligent digital technologies has formed the concept of smart cities. It is noteworthy that the concept of smart cities is increasingly considered not only from a technological point of view, but also from an economic, social and environmental point of view. This makes it attractive to researchers from various scientific disciplines, such as urban planning, architecture, economics, ecology and psychology.

In the author's understanding, an economic mechanism is an instrument of influence that characterizes the process of managing an object. The structure of such a mechanism includes a set of certain elements: the object is an element that changes under the influence of management actions; subjects are elements that influence the managed object, carriers of subject-practical activity participating in the functioning of the mechanism; the procedure for the functioning of the mechanism, combining a set of functions, management actions, methods and ways of achieving management goals.
Based on the above, the mechanism of public management of a smart city is defined by the author as a set of measures, decisions, actions of government institutions, business and society to provide resources, tools, technologies for planning, organizing, motivating, monitoring and regulating the processes of formation and development of a smart city.

Public administration is the main source of management actions, while the mechanism is a subordinate, executive body that ensures their implementation. This means that the public administration mechanism cannot exist without participation, since it is an integral part of the interaction of participants in the smart city ecosystem in the process of developing a smart city, taking into account participation. The implementation of the ideas for the development of a smart city ecosystem occurs thanks to the functioning of the mechanism of public management of a smart city.

The practice of public administration of modern cities shows that at present, at the legislative level, there are often no specific goals and objectives for the management of urbanized territories. In essence, the main goal of management structures is reduced to solving current and short-term problems of a local nature, while issues of strategic development of urban areas are given insufficient attention. Methods of public management of urban areas, aspects of strategic development of modern cities are not sufficiently regulated by legal norms, have not been studied in management theory, are not fully developed and are not widely used. In addition, there is no single scientifically based understanding of public administration of a modern city. At the present stage of development, the management of socio-economic systems of various levels is acquiring new features, including openness, public participation, and active use of digital technologies. This approach allows combining top-down management models based on the control influences of government structures and bottom-up models, where self-organization of management objects prevails, which allows maintaining a balance of interests of participants in the smart city ecosystem. As the practice of managing socio-economic systems at various levels shows, effective implementation of management tasks is possible on the basis of coordinating interests, not only through the official establishment of various generally binding rules by the state, local government bodies, and public organizations, but also with the help of norms and rules of conduct developed by society itself, a group of citizens, and non-governmental bodies. Public administration in a modern city involves the active involvement of the local population and business community in solving issues of managing the socio-economic development of the territory. The basis for such involvement is the tools for exchanging data between various participants in the urban management ecosystem. In this regard, digital data becomes the basis for making management decisions, the main resource for improving the quality of urban environment management.

City authorities must understand and use the new opportunities that become available to them through technological progress and changes in the socio-political culture of society to implement smarter methods of managing the urban system. There is a growing demand from civil society for broader participation in decision-making processes. The combination of technological advances with new demands of civil society in relation to the system of management decision-making is a powerful force that will change the very system of public administration of socio-economic systems at different levels. Such a system will likely be based on new methods and tools of public administration based on the use of digital solutions, as well as the strengthening of the role of citizens in decision-making processes due to the prevalence of communication channels and the exchange of opinions in real time.

Based on the evolutionary approach to the process of managing urbanized territories in the context of digitalization, we have identified normative, economic, social, and combined types of the mechanism of public management of a smart city, taking into account participation:

- normative - a mechanism in which, within the framework of public management of smart city development processes, formal institutions dominate over the institutions of society; vertical connections are predominantly used and the functions of regulation and regulation prevail;
- economic - a mechanism in which, within the framework of the implementation of smart city initiatives, the interests of individual high-tech companies or their associations prevail, offering their own technological solutions for the development of smart cities;
- social - a mechanism in which, within the framework of the development of smart cities, institutions of self-organization of the population prevail, citizens' initiatives are implemented; horizontal connections are mainly used and the functions of organization, motivation, and regulation prevail;
- combined - a mechanism in which, within the framework of public management of the development of a smart city, parity participation of public authorities and public institutions is formed; matrix connections are mainly used and the functions of coordination, motivation, and regulation prevail.

2 METHODS

The object of the study in this article is the concept of public management of smart cities. The subject of this study is the features of the mechanisms of public management of smart cities. The analyzed data are scientific research reflected in the periodical press, as well as the author's results within the framework of research into the concept of a smart city. The research method is a logical analysis of public management mechanisms of smart cities. The research algorithm was as follows: 1) smart city management methods were considered; 2) types of smart city management mechanisms were identified; 3) features of the typology of public management mechanisms of smart cities were systematized; 4) a typology of public management mechanisms of a smart city was developed.

3 RESULTS

The study systematized the features by which it is possible to differentiate the types of public management mechanism of a smart city. Such features include the type of relationship, the type of connections, the predominant functions, the scale of implementation and the type of effect.

Typology feature	Types			
	Normative	Economic	Social	Combined
Type of relationship	Organizational and economic	Economic	Socio-economic	Socio-economic
Type of connections	Vertical connections	Horizontal connections	Horizontal connections	Matrix connections
Predominant functions	Regulation	Regulation, coordination	Organization, coordination, motivation	Regulation, coordination, motivation
Scale of implementation	Broad, changing depending on the involvement of government structures	Broad, changing depending on the involvement of business structures	Local, limited	Broad, changing depending on the number of groups of society involved
Implementation tools	Regulations, strategies, acts	Market	Self-organization tools (local communities, groups in social networks)	Digital platforms, portals that allow interaction between society and government

Figure 1: Typology of public governance mechanisms for smart cities

Based on the above typology, we can describe the evolution of the public administration mechanism. As practice shows, the development of smart cities begins either on the initiative of government agencies (normative approach), or on the initiative of individual technology companies in the field of digital technologies (economic approach), or on the basis of self-organization of the population and the implementation of individual local projects (social approach). The combined approach, in turn, is a combination of the normative, economic and social type of mechanism, which determines its continuity.

To build an optimal mechanism for managing smart cities in the Russian Federation, it is necessary to use the accumulated experience of creating and operating such systems, conduct a selective selection and transplantation of positive experience. Participatory processes in the development of smart cities play a key role in solving urgent socially significant problems. The interaction and responsibility of government institutions and society are key conditions for the effective development of territories. Government institutions that do not pay due attention to feedback from society must change their approach to participation in public administration to a more active one that promotes the development of this process.

The mechanism of public management of smart city development initiated by government structures is based on the top-down principle and includes such participation tools as information, public discussion and identification of public opinion. At the same time, the management mechanism initiated by business structures is based on the principle of participatory participation and includes such tools as consultations and cooperation.

The public governance mechanism initiated by the population is based on such instruments of participation in the processes of making management decisions as civil initiative, appeals, participation in the activities of public authorities, expert (public) assessment and is characterized by the vector of "bottom-up" orientation. From our point of view, within the framework of the study of the public governance mechanism within the framework of the development of a smart city, it is advisable to distinguish three main groups of participants in the ecosystem of a smart city (government, business, population) due to the fact that these participants often have different priorities within the framework of the development of smart cities.

From the perspective of public authorities, it is important to plan the development of urban areas taking into account new trends in the use of digital technologies and innovative solutions. For this purpose, strategies and plans for the development of smart cities are developed, and standards and regulations are established that should be a priority for government agencies. From the point of view of private technology companies participating in the development of smart cities, their priority is often their own interests.

They seek to generate income from participation in the digitalization of the urban environment, promote their technological solutions on the market and increase the share of services provided. From the point of view of the local population, the main goal of public administration is to solve socially significant problems. This approach is fully consistent with the goals of social development promoted within the framework of the smart city concept.

The main objective of the participatory mechanism of smart city management is to solve the problems of the local population, improve the quality of life by taking into account the interests of the government, business and the population in a balanced manner. The development of participatory relations in the smart city ecosystem contributes to the achievement of strategic goals and the solution of specific tasks related to smart city projects. Examples of such tasks can be innovative development of territories, scientific and technological development, improving the quality of human capital and other interrelated tasks. The participatory mechanism of smart city management within the framework of the development of urbanized territories includes a number of actions that can be defined as its functions:

- *Ensuring interactions between ecosystem participants.* Implementation of smart city projects in various areas of urban economy together with government agencies, businesses, and the population: security, ecology, housing and utilities, transport, education, and healthcare. Ensuring organic interaction between public authorities and businesses and the population, increasing the effectiveness of decisions made.

- *Ensuring stable functioning of governing bodies.* Effective influence on processes occurring in society, internal consistency, implementation of management functions, creation of opportunities for business and local population to participate in management decision-making processes.

- *Providing feedback.* Receipt and adequate response from management structures to signals coming from business, the population, and expert communities.

- *Ensuring transparency of management processes*. Increasing openness and transparency of the functioning of public authorities of a smart city.

For the public administration mechanism to function effectively, it is necessary that the governing bodies and their decisions enjoy trust. Trust in the authorities depends on the public's awareness of the problems and the transparency of management procedures. The experience of various countries shows that the use of a participatory governance mechanism promotes broad involvement of stakeholders and more effective implementation of social development tasks. However, the complexity of introducing a participatory approach to the management of socio-economic systems of different levels is associated with the diversity of interests of the participants in the interaction.

The experience of digitalization of the urban environment and development of modern cities shows that this process goes through a number of stages related to the development of information and communication, digital technologies and data processing tools. In this regard, four stages of urban environment development can be distinguished: industrial city, information city, digital city, smart city.

Apparently, each of these stages corresponds to its own mechanism for managing the urban environment. From our point of view, four stages can be distinguished in the development of the management mechanism depending on the type of urban environment: administrative, economic, social, combined.

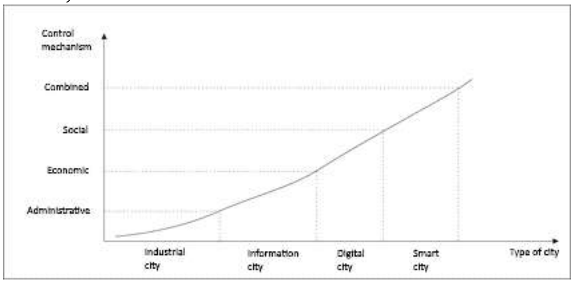

Figure 2: Evolution of management mechanisms depending on the type of city.

4 DISCUSSION

Modern digital technologies significantly simplify communication processes and influence management in modern society, making it more participatory. The use of digital platforms, social networks and messengers reduces the costs of interaction between participants in socio-economic systems, including smart cities. In this regard, within the framework of public management of urbanized territories, electronic democracy tools are increasingly used and digital platforms are created for interaction between local governments, the population, business and the expert community on issues of territorial development in general, within the framework of the implementation of smart city projects. In some cases, where routine management procedures lend themselves well to digitalization, decision-making is based on artificial intelligence, eliminating human participation in the management decision-making process.

When studying the problems of managing socio-economic systems of different levels in the context of the formation of a digital society, it is important to note another effect. When using digital technologies, a significant part of society generates huge amounts of digital data that circulate in the digital environment. Even if the user does not directly participate in management processes, his digital data can be used to make management decisions. For example, data from mobile operators on population movements can be used to optimize traffic flows in the city. This allows us to conclude that digital technologies facilitate hidden or indirect participation in management decision-making processes.

5 CONCLUSIONS

The evolution of digital technologies has radically transformed the priorities in the development of modern cities. Today, there is an increased interest in the use of digital solutions as tools for improving social infrastructure, urban economy and forming new models of urbanized territories management. In the course of this study, important theoretical and practical results were obtained aimed at developing a mechanism for public management of modern cities in the context of digital transformation.

Firstly, the existence of different types of cities is substantiated based on their level of digitalization.

Secondly, a typology of mechanisms for managing urbanized territories in the context of digitalization has been developed, and the features of the mechanism of each type have been shown.

Thirdly, the evolution of approaches to public management of cities in the context of large-scale implementation of digital technologies is shown.

The conducted study has theoretical significance, as it is aimed at developing a typology of mechanisms for public management of modern cities. This will allow for effective management of various aspects of city life using modern technologies and digital solutions.

In addition, the study has practical significance, as it contributes to the formation of possible future research in the field of smart governance in a digital society. This will allow us to develop new approaches and strategies for the effective development of urbanized areas.

ACKNOWLEDGEMENTS

The study was supported by the Russian Science Foundation within the framework of the scientific project 24-18-20036, https://rscf.ru/project/24-18-20036/

REFERENCES

Lee, J. H., Phaal, R., Lee, S.-H., 2013. An integrated service-device-technology roadmap for smart city development. Technological Forecasting and Social Change, 80(2), 286–306.

Rabari, C., Storper, M., 2014). The digital skin of cities: urban theory and research in the age of the sensored and metered city, ubiquitous computing and big data. Cambridge Journal of Regions, Economy and Society, 8(1), 27–42.

Angelidou, M., 2015. Smart cities: A conjuncture of four forces. Cities, 47, 95–106.

Van der Graaf, S., Veeckman, C., 2014. Designing for participatory governance: assessing capabilities and toolkits in public service delivery. Info, 16(6), 74–88.

Anttiroiko, A.-V., 2016. City-as-a-Platform: The Rise of Participatory Innovation Platforms in Finnish Cities. Sustainability, 8(9), 922.

Gil-Garcia, J. R., Pardo, T. A., Nam, T., 2015. What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization. Information Polity, 20(1), 61–87.

Gupta, R., Mejia, C., Kajikawa, Y., 2019. Business, innovation and digital ecosystems landscape survey and knowledge cross sharing. Technological Forecasting and Social Change, 147, 100–109.

Lim, C., Kim, K.-J., Maglio, P. P., 2018. Smart cities with big data: Reference models, challenges, and considerations. Cities.

Mayangsari, L., Novani, S., 2015. Multi-stakeholder co-creation Analysis in Smart city Management: An Experience from Bandung, Indonesia. Procedia Manufacturing, 4, 315–321.

Ji, T., Chen, J.-H., Wei, H.-H., Su, Y.-C., 2021. Towards people-centric smart city development: Investigating the citizens' preferences and perceptions about smart-city services in Taiwan. Sustainable Cities and Society, 67, 102691.

Michelucci, F. V., De Marco, A., Tanda, A., 2016. Defining the Role of the Smart-City Manager: An Analysis of Responsibilities and Skills. Journal of Urban Technology, 23(3), 23–42.

Yeh, H., 2017. The effects of successful ICT-based smart city services: From citizens' perspectives. Government Information Quarterly, 34(3), 556–565.