



Institutional Support of a Smart City*

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ABSTRACT

The purpose of this study is to determine the conditions of institutional support for the digitization of the urban environment. The paper identifies the main features and analyzes the conditions for the effective functioning of smart cities. The main characteristics of the smart city are revealed: they are people-oriented, use data in a digital format and are based on bottom-up innovations. The paper considers the systematization of the principles and ideas of the theory of institutional modeling from the simplest level of modeling, and ending with the most difficult level consisting in describing the evolution of institutions. The importance of applying such an approach to the study of the institutional support of smart cities is shown. As part of the study of the leading cities in the field of building smart urban environment, priorities, institutions and goals of intelligent development have been highlighted. The paper discusses the problems of the development of smart cities in Russia, presents a number of steps to solve them. The theoretical significance of the study consists in the development of approaches to the institutional support of a smart city. The practical significance of the research lies in the formation of possible future studies of rational economic management in the conditions of digital society.

INTRODUCTION

Modern processes of urbanization and development of urban areas cause a number of socio-economic, technological and organizational problems. As cities face such challenges, they need to be more flexible and farsighted when planning population growth and change, as well as influencing various aspects of urban life, such as transport, education, health, and environmental pollu-

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tion. The digital era is fundamentally changing the way in which urban communities function. Social development in the new conditions is associated primarily with the creation of social innovations, the development of partnerships and the stability of social unions, and the involvement of citizens in solving social problems. New challenges of our time, economic, demographic and environmental problems force us to create communities based on the principles of openness, involvement and awareness. Tools for social development in such conditions are intelligent systems based on cloud computing and remote data warehouses, online collaboration systems, and social networks.

Faced with modern challenges, cities are increasingly investing in the creation of intelligent systems aimed at improving the quality of life of citizens and urban communities. In the past two decades, thanks to the rapid development of digital technologies, the concept of “smart cities” has gained considerable popularity, and many cities have begun to take a more holistic approach to improving urban services on innovative principles. The concept of “smart cities” is very close to other similar concepts, such as digital, intellectual and creative cities (Hollands, 2008; Kola-Bezka et al., 2016).

Despite the existence of different approaches to the definition of “smart city”, the main idea of this approach is to use digital technologies for improving the quality of life. Currently, investments in order to create an innovative infrastructure of urban development are beginning to be made in many cities of the world. One of the most important rationales for such decisions is to increase the use of energy resources and reduce emissions to the environment. Energy saving is considered as one of the main advantages and is usually calculated in the cost-benefit analysis.

The transformation of the principles of the urban structure has formed new directions in the field of development of socially significant areas: “smart environment”, “smart management”, “smart transport system” and “smart energy system” (Hollands, 2015; Strielkowski, 2017). For example, in the field of transport, the concept of “smart mobility” has emerged - a series of transport initiatives that are integrated with broader urban efforts through technology to improve viability, competitiveness and sustainability. In general, smart development ideas have three main characteristics: they are people-oriented, use data in a digital format and are based on bottom-up innovations.

Traditional urban systems are aimed at improving efficiency by increasing quantitative indicators. In the digital age, efficiency is enhanced by the quality component. Intellectual systems are aimed at making users not only consumers of services, but also producers of such services - “prosumers” - who jointly create these services with government organizations, business or other interested parties. This focus on people requires significant interaction with users in order to understand their needs and evaluate their behavior, as well as to provide personalized services (Kaczorowska-Spychalska, 2018). At the same time, the urban environment is faced with the problems of maintaining and updating the necessary infrastructure and creating open innovation processes that meet the needs of citizens. Despite a sufficient amount of research in the development of the urban environment in terms of digitalization, most of them are highly specialized. At the same time, in the social sciences there is still no adequate toolkit for modeling the digitalization processes of the urban environment. From our point of view, institutional modeling can become an important tool in this case. Thus, the purpose of this study is to determine the conditions for institutional support of the digitalization of the urban environment.

1. INSTITUTIONAL APPROACHES TO URBAN DEVELOPMENT

The systematization of the principles and ideas of the theory of institutional modeling should be carried out sequentially, starting with the simplest level of modeling, that is, institutional design, and ending with the most difficult level consisting in describing the evolution of institutions. For intermediate levels of modeling, the following stages of the modeling approach can be consistently

included: systematization, formalization, classification, distribution and measurement of economic institutions.

The design of economic institutions is based on the application of specific rules governing the use of resources. Systematization of economic institutions is based on certain criteria for the effectiveness of the system, realizing the various functions of institutions. The system classification of economic institutions reveals the saturation and vector of development of institutional theory. The practical significance of the classification of economic institutions lies in the development of methods for managing institutional effects.

The distribution model for economic institutions can be presented in the form of a hierarchy of rules. Consequently, the modeling of the distribution of economic institutions is possible on the basis of the functional hierarchy of established norms for the interaction of economic agents. The distribution of economic institutions can be presented in the form of an institutional atlas (Popov, 2011). Since the atlas is traditionally a hierarchical system, the institutional atlas includes a consolidated classification of institutions, which combines several types of institutions studied in accordance with various criteria. Hierarchical systematization of institutions is possible in accordance with the following criteria: place of origin, area of knowledge, control functions and spheres of activity. Endogenous institutions can be distinguished from exogenous institutions by place of origin. The first arise inside the object, and the second are formed outside the object. It is advisable to distinguish between institutions in terms of areas of knowledge, that is, social, technological, economic, political and cultural. Also, institutions can be divided according to management functions: planning, organization, promotion and control of economic activity. The above systematization criteria form an atlas of institutions in which they are presented in a specific order.

The measurement of economic institutions is based on the theory of transaction costs, according to which the institutional structure of an economic system can be measured by the cost of transactions, as well as the formation and maintenance of these economic institutions. The general principle is to model the evolution of economic institutions on the basis of taking into account the resource potential and the formation of the institutional structure of the system being analyzed. Therefore, the idea of the theory of institutional modeling is that the modeling of the evolution of economic institutions is possible by assessing the impact of exogenous and endogenous factors on the dynamics of changes in these institutions.

Currently, questions of institutional economics in relation to the development of urban areas attract the attention of a significant number of researchers, while the questions concern a wide range of problems (Raven et al., 2019; Zhou, 2018). A number of studies are aimed at finding solutions to overcome the imbalance in the development of territories relating to the issues of ineffective distribution of powers. As the example of a number of states shows, it is necessary to create appropriate institutions that promote the active participation of the community in planning and executing decisions at the local level (Kandpal et al., 2019). The creation of specific institutional mechanisms, such as working groups or committees with representatives of various stakeholders, leads to a balance of interests of different parties (Radovic et al., 2018).

A large number of studies related to the problems of ecological development of territories (Kobayashi et al., 2017; Jepson and Haines, 2014). The proposed models and results of research in the field of sustainable development are based on the analysis of institutions that determine the rules, norms and strategies of sustainable development (Mincey, 2013). In some cases, the institutional analysis of urban development affects related areas, for example, the environmental direction is linked to the study of transport and energy (Hudec, 2017). Often, the need for a regional spatial scheme is emphasized, where the calculation of the cost of conservation plays an important role, as well as the need to develop green infrastructure in urban areas with limited public financial resources (Murayama, 2017).

As an effective way to ensure sustainable ecological, economic and social development of cities, a number of studies suggest policies that support a polycentric organization. Most megacities

lack effective institutions for solving social problems of collective action that could contribute to land use policies, transport, supporting polycentric or other sustainable spatial strategies. Such studies concerning a polycentric spatial strategy model development conditions based on inter-level links between local, regional, and national structures (Rader Olsson and Cars, 2011). Issues of ineffectiveness of institutional structures are also given considerable attention in modern studies. Institutional voids are the cause of inefficiency, manifestations of institutional traps, which are quite common especially in developing countries. Lack of transparency in the formulation and implementation of policies is another aspect that is commonly observed in emerging economies (Sardana and Zhu, 2017).

The study of formal institutions, enshrined in the form of documents, is one of the most common approaches to the institutional analysis of urban areas. The research algorithm in this case consists in differentiating the territories according to certain characteristics and comparing their formal institutional support. For each of these large urban agglomerations, a number of key documents are introduced and evaluated to ensure an understanding of their approach to managing urban change. At the same time, their existing institutional base is analyzed in relation to planning and policy in urban management. These documents constitute key elements of formal planning systems (for example, urban development plans or regional integrated plans). In addition to spatial plans, other strategic documents are being analyzed that have a clear impact on the management of urban change, complementing spatial plans in various ways (Schmitt, 2013).

A significant part of the research in the framework of urban environment development is devoted to the impact of institutional mechanisms on economic growth (Thornley, 1998). Researchers note that adequately assessing the institutional structure of a large city is not easy. Recently, the structures have become very complex and are also subject to constant changes. The history of institutional change illustrates the growing complexity of the decision-making process. An increasing number of organizations are involved in such processes, and the relations between them are becoming more complex and difficult to define. Often there is no coordination and overall development strategy. Such attributes are increasingly seen as vital in inter-urban competition (Engel et al., 2018). Rapid urbanization creates risks and opportunities for smart development. Urban policy and decision makers are faced with the increasing complexity of cities as socio-ecological and technological systems. Consequently, there is a growing need for joint development of principles that support the overall sustainability of the system, and provide transformational changes at various scales in order to adequately respond to a changing situation. Such holistic urban approaches are rare in practice. Research in the field of systemic digitization of the urban environment identifies a set of measures, usually reduced to three stages: (1) the formation of a common structure to support a more systematic development and use of knowledge, (2) the identification of barriers that create a gap between stated urban goals and actual practice, and (3) identification of strategic target areas to close these gaps. The development of integrated strategies in such conditions is considered as the most urgent need (Webb, 2018; Poór et al., 2018).

As practice shows, institutional modeling of urban development opens up prospects for research in the social sciences on urban change. The conceptualization of the urban environment as a multidimensional or hybrid system is a key feature of research in this area, and an understanding of development as a set of nested adaptive cycles helps to understand the causes of changes and sustainability of urban systems (Lang, 2011).

2. RESEARCH PROCEDURE

As an object of research in this article we examined the modern economy of the urban environment in the conditions of digitalization and the development of the concept of a "smart city". The subject of this research is economic relations that are being formed in various directions within the framework of the development of a smart city. The analyzed data are scientific studies reflected in the periodical press, as well as the author's results in the framework of research on the

digitalization of the urban environment. Research methods are the elements of institutional modeling, a logical analysis of the applicability of digital technologies for various levels of economic activity. Algorithm of research - from the general to the particular. First, the general institutional conditions are systematized, then, using the example of the development of digital society in the Russian Federation, specific instruments of institutional transformations are proposed.

3. DEVELOPMENT INSTITUTES OF SMART CITY

The people-centered principles for implementing smart cities initiatives emphasize the importance of identifying problems and evaluating them from users. These solutions must meet the real needs of people. This approach reveals the enormous potential for using public information about users, which can lead to the formation of new data sources and an increase in the efficiency of economic activity. User orientation makes it possible to align interests for the public and private sectors. In such conditions, the satisfaction of digital users becomes a new business model. All stakeholders have common interests in order to maximize their needs. At the same time, people-orientation brings great problems. The behavior of people is complex, heterogeneous and changing. In such conditions, the issue of confidentiality and security is increasingly becoming more acute with the personalized information obtained and used in these initiatives. Concerns about privacy and security can scare off new users or destroy the trust of existing users.

Intellectual systems collect a large amount of data, and now they are becoming the main resource for the development of smart cities (Vermeulen and Pyka, 2017). Such data is enriched by the sense of integration with other sources of information and, therefore, have much more applications than traditional ones. Urban life is changing thanks to faster data flows. Data is becoming a new production factor that stimulates productivity and innovation. Thanks to the ability to collect, integrate, analyze and visualize data, thanks to the rapid development of technologies and algorithms, information services provided to users are changing in a revolutionary way. Digital systems use huge sets of personalized real-time data to analyze the current situation. The ability to work in real time turns an infrastructure problem into a data processing problem, since less infrastructure is required if it can be used more efficiently with quality data (Sun et al., 2016). The ability to collect and analyze big data, as well as to distribute it among the public, becomes the main competence for intelligent applications in solving the problems of digitization of the urban environment.

The modern concept of smart cities is a holistic approach that affects various aspects of people's lives. In this context, it is necessary to combine a multitude of areas that are interrelated with land use planning, housing, the environment, energy, health, public safety, economic development and information technology. The successful implementation of ties requires cooperation and integration across sectors, which is extremely difficult, given the generally accepted structure of city authorities. The smart technology market for smart cities benefits from bottom-up innovations. New ideas and applications for the implementation of initiatives to digitize the urban environment are motivated and stimulated by the needs of citizens and private companies, as well as start-ups. Cities use these innovations from the bottom up, as they not only provide services at lower cost to the city, but also provide high-quality jobs and increase the efficiency of the economy (Nicolescu, 2018).

Such upward innovations bring jobs to the labor market, low-cost government services, as well as competition, entrepreneurship development, increase skills and opportunities. However, they can also be a source of problems for urban development. For example, Uber and other companies have caused changes in the traditional transportation industry in many cities, and in some cases even caused conflicts. In such conditions, it is quite difficult to find a balance between encouraging innovation and meeting the needs of citizens, while maintaining the necessary control over public safety and social justice. The following stages in the development of smart cities can be distinguished (Table 1).

Table 1. Main directions and conditions of institutional support for digitization of urban environment

Stages	Main directions	Conditions of institutional support
Identified the problem and developed an intelligent solution.	People oriented Innovation	Public participation Public private partnership Participation of scientific organizations
The solution is deployed and operated.	Long-term planning Data exchange	Contract Management Data monitoring Interagency coordination Data exchange between users Open data
Users use the solution and change their behavior accordingly.	Energy saving Behavior change Agreed Green Policy	Information sharing for confidence building Public participation Internet Marketing Enhance education Development of public-private partnership Ensuring privacy, security
The solution scales and evolves over time.	Evaluation and monitoring	Involvement of all stakeholders Measuring and evaluating results

Source: Compiled by the authors

Identification of the problem of urban development and the development of an intelligent solution. The key point in this case is that the intelligent solution is designed to solve the existing problem. *Deploy and operate an intelligent solution.* The city must have the resources and capabilities to implement the solution and ensure its sustainability. *Users use the solution and change their behavior accordingly.* The fact that service users want and can use the application and change their behavior is the most important step. *Development and expansion of the intellectual decision.* Intelligent solutions must be financially sustainable in the long term, taking advantage of the network and economies of scale to maximize benefits. A healthy “ecosystem” should also be cultivated to enable learning and development to adapt to future changes.

Consider the stages of development of smart cities in more detail. Since the use of digital technologies is a driver for the development of smart cities and lies at the center of these initiatives, cities are paying too much attention to investing in the technologies themselves and ignoring the real goal of improving the quality of life of people. One of the problems associated with the implementation of the initiatives of the smart city is their focus on the advancement of technology. Investments made only for the sake of technology introduction, rarely bring the maximum benefit to people. Identifying a problem that concerns people is the first step. Institutional conditions at this stage include a public participation channel for identifying and assessing problems, as well as creating conditions for cooperation for all players. The search for innovative ideas in urban "living laboratories" and at public events is very useful at this stage. Creating channels that allow the public to express their ideas is the best way to solve the problems. Along with modern communication channels (online applications and social networks) it is necessary to use traditional communication channels. Currently, many successful initiatives are being built together with e-government initiatives (Paulin, 2016).

Equally important is effective cooperation between the public and private sectors in the development of smart cities. Such joint associations can be implemented in the framework of scientific and industrial associations or industry associations (Rabari and Storper, 2015). Such collaborations operate in developed countries, such as Japan, the United States. An example is the Council on Smart Cities in the United States, an industrial coalition promoting solutions for smart cities, offering a platform with opportunities for collaboration in the form of knowledge sharing, collabora-

tive research, forums and trainings. Innovation is a key aspect at the stage of identifying the problem of urban development and developing an intelligent solution. Increasingly, city authorities are realizing the power of civil society and cooperation with it. In some cases, civilian innovation laboratories or urban “living laboratories” are created, and events such as open data contests and innovation contests are often used to get ideas for intelligent solutions. In some cities, this approach is also used when data, source codes for software, and technical specifications or designs for hardware are open and shared to stimulate innovation (Okwechime, Duncan and Edgar, 2018).

At the stage of deploying and operating an intelligent solution, the most frequently encountered problems are problems of financing, inconsistency of authority, use of data. The development of institutional conditions for contract management and monitoring is necessary. Institutional mechanisms for sharing data, inter-agency and open data practices are also important. The implementation of intelligent urban solutions is a rather complicated, long-term and costly process. The city must have long-term planning tools. Usually, such a strategy is an urban development strategy. An example of such a solution is the transport strategy of the city of Helsinki until 2025, according to which the city plans to provide citizens with an application for smartphones that functions as a travel planner and universal payment platform, combining all possible modes of transport in the city, including metro, buses, ferries, car sharing in a single package of services that functions in real time.

Multidirectional interests of urban structures are the main obstacles to the deployment and operation of digitization projects. In such conditions, a governing body is needed to promote cooperation and integration of various structures in the city. For example, in many cities (Amsterdam, Barcelona and Seoul) there is a chief technical officer (CTO) or chief information officer (CIO), reporting directly to the head of the city. Such an official plays a leading role in the implementation of intelligent solutions without bureaucratic obstacles, and also promotes learning, communication and cooperation between various structures in all sectors. Appropriate institutional support is also needed in the field of open data. These mechanisms include identifying the owner of the data, rights and obligations to collect, use and share data depending on the type of data, including important aspects of confidentiality, security and ethics. These questions need to be answered to avoid potential conflicts between parties (Sulkowski 2012).

One of the main problems in implementing initiatives to digitize the urban environment is changing user behavior. Many factors affect user behavior. Cities can influence the choice of citizens in the framework of the implementation of the concept of development through various strategies. This requires the development of a consistent policy to direct users towards using the most intelligent solutions. It's difficult to change behavior, and users are not at risk if they do not believe that they will benefit from the solution. Therefore, it is important for cities to encourage public participation in the design and implementation of smart solutions. Cities should be open, using channels to communicate with users about intentions, benefits, costs, deadlines and other attributes of an intelligent solution. Openness and exchange of information with users is especially important when errors occur with the service provided so that users do not lose confidence (Giest, 2017).

People living in different cities, with different professions, age and gender, behave differently. Therefore, before introducing intelligent solutions, it is necessary to study the needs or implement pilot projects in order to understand the behavior of users. These behavioral factors should be taken into account and reflected in the draft decision. Thus, the public and private sector should work together to influence users through educational and marketing opportunities, using methods such as information campaigns, financial incentives, and the use of social networks. Intellectual initiatives should be innovative to attract the users. Big data is also a tool for personalizing many marketing and educational initiatives. Because smart solutions use real-time personalized data, privacy and security considerations can deter some users. Users stop using these services after security breaches because they see a risks. Infrastructure and user interfaces should be designed for easy and convenient use, taking into account the technological capabilities of users. For example, if the

penetration rate of smartphones is not very high among the target users, applications for smartphones should be complemented by traditional communication methods.

To get the maximum benefit, intelligent solutions must expand and evolve over time. Therefore, the financial sustainability of such solutions is important in the long term, taking advantage of networks (penetration is one of the key parameters leading to maximum benefits) and economies of scale. All digitalization players want to get more users and expand. However, different players have different goals and programs. To develop a sustainable business model for scaling up smart solutions, it is important to involve all potential players (those who can benefit, as well as those who can suffer) and reconcile their interests. Involving all players maximizes potential funding and also reduces the risk of conflict in the future. For evolution of a smart city, it is important to develop a technical ecosystem with products, experience, skills and a community conducive to learning. This ecosystem includes technology providers and device manufacturers, solution providers, system integrators, data aggregators, data analysts, network designers, Internet security specialists, application developers, investors and entrepreneurs. This ecosystem can be cultivated through open data and knowledge-sharing activities, such as seminars, trainings, conferences and forums.

4. INSTITUTIONAL DEVELOPMENT OF A SMART CITY

The study of the practices of the development of smart cities in such examples as London, Seoul, Tokyo, allows us to highlight the main priorities of the formation of intelligent urban environment (Table 2).

Table 2. Priorities and institutional support for smart city digitalization

<i>Priorities</i>	<i>Institutes</i>	<i>Goals</i>
Citizen involvement	Consultation with citizens through online platforms Reducing digital inequality Enhance education Increasing the number of entrepreneurs in IT	The growth of the online community The increase in IT entrepreneurs
Open data	Data sharing practice	Increase the number of users of open data
Development of research and entrepreneurial potential	Innovation promotion strategy to attract investors Innovation Export Program Program to attract talented professionals	Increase in high-tech exports Creating high-tech jobs
Collaborations	Innovation network, bringing together smart city initiatives Cooperation with other cities, exchange of experience and implementation of pilot projects	Growth in the number of joint projects
Infrastructure	Support and advancement of smart technologies Business practices based on open data Assessment of long-term infrastructure needs Creating a digital city platform Internet access plan	Increase in the rating of cities in terms of digital development Reduced power consumption Carbon Emissions Reduction
Governance	Strategy for the introduction of digital technologies in the public sector	Improving the efficiency and convenience of administrative services

Source: Compiled by the authors

Attempts to develop the urban environment on the basis of the concept of a smart city are carried out in Russia. A number of large cities have developed strategies of growth that include certain elements of a smart city. It should be noted that currently there is no comprehensive strategy for the development of smart cities in the Russian Federation. In particular, at present the concept of "smart city" and related activities are not fixed in the legislation. There are no conditions for the formation of a unified digital environment of trust in the implementation of smart city technologies. The processes of collecting, aggregating, processing and managing data within a single information system have not been worked out. The issues of providing data by all data holders are not resolved, the requirements for the introduction of digital technologies and the system of corresponding preferences are not regulated. In addition, there are no mechanisms for regulating the characteristics of the use of special technological solutions and software products in various fields.

Solving these problems requires appropriate institutional changes, including the creation of an appropriate body at the level of the Government of the Russian Federation on the development of smart cities, the development of a system of national standards in the field of smart cities, including standards defining common terms and concepts, as well as the relationship between them; securing the priorities of smart growth in the basic documents of strategic development; evolution of a system for monitoring and evaluating the development of smart cities; creating a system of tax and grant incentives for smart cities; the formation of a technological consortium of companies offering the most effective solutions for the urban economy; creation of technology parks and platforms for testing technological innovations; instruments of crowdfunding.

In the conditions of the digital revolution taking place in the world, the introduction of smart technologies into urban management processes is an inevitable prospect for Russian cities. The factor of digital technology is fundamental to the modern generation of smart cities. Therefore, the long-term development trend of Russian cities is closely related to the implementation of this approach. The degree of state participation in the processes of digitization of the urban environment and the introduction of smart city technologies may be different. Taking into account Russian realities, the most productive way is to minimize administrative barriers and create institutional conditions with the aim of stimulating the introduction of digital technologies. Given the complexity of urban systems, building a cooperative relationship and partnership with various business entities and companies becomes a key aspect for implementing smart technologies. The driver for the development of processes of digitization of the urban environment can be the implementation of pilot projects within the designated pilot areas. Spaces for experiments in this case can be either whole cities, or special test sites or "living laboratories" (Leminen, Rajahonka&Westerlund, 2017). At the same time, we note that the main challenge for the development of smart cities in Russia and the digitalization of the urban environment is not related to the technological aspect, but to resource constraints and imbalances of authority between the center and the regions (municipalities). Therefore, without reforming the existing management system, tax and budget legislation, the development of smart cities will be difficult.

CONCLUSION

The study of world trends shows that the level of socio-economic development of countries, regions and cities is closely related to the introduction of digital technologies. The development based on the concept of a smart city contributes to the introduction of new technologies, the solution of socio-economic and environmental problems. This often requires a review of the established principles of socio-economic development and the formation of the institutional foundations of a new level.

In this study, which we conducted to determine the conditions for institutional support of the urban environment, the following theoretical and practical results were obtained.

First, the main characteristics of smart development are revealed: they are people-oriented, use data in a digital format and are based on bottom-up innovations.

Secondly, the systematization of the principles and ideas of the theory of institutional modeling from the simplest level of modeling, and ending with the most complex level consisting in describing the evolution of institutions, is considered. The importance of applying such an approach to the study of the institutional support of smart cities is shown.

Third, the stages of the development of smart cities are highlighted, including the identification of the problem, the implementation of the solution, the involvement of users, the scaling of the solution. The institutional conditions for the successful implementation of each stage are presented.

Fourthly, based on the analysis of the literature, the priorities, institutions and goals of intelligent development of a number of leading cities in the digitization of the urban environment are highlighted.

Fifth, the problems of the development of smart cities in Russia are considered, a number of steps to solve them are presented.

In conclusion, we note that the multidimensional and multifaceted concept of smart cities requires the development of a number of goals that must be achieved in the process of socio-economic development, while all stakeholders should be included in the design of smart cities. To monitor the effectiveness of projects and initiatives, all goals must be measurable. Citizens should participate in all stages of creating a smart city, starting with a discussion of the concept and ending with the stage of testing specific solutions.

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