

DOI: 10.32347/2786-7269.2025.13.196-207

УДК 711

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## INCLUSIVE ASPECT OF SMART CITY FORMATION

*The work defines the main issues of smart city formation, taking into account demographic, spatial, social, informational and economic factors. The experience of the leading global trends in the principles of «smart cities» formation to ensure balanced economic, ecological, social and technological urban development is also summarized. The main technologies for the «smart cities» development are defined (resource-saving, energy-efficient technologies and renewable energy), with inclusive direction key technologies definition. The main prerequisites of the inclusive aspect of «smart cities» system formation classification and their main features are considered. A «smart city» is seen as one that meets the current citizens needs in various aspects of their lives. The design of such settlements is currently one of the world's priority policies. It was determined that the development and formation of smart cities should be inextricably linked with the Inclusive Strategy development and implementation for the systematic formation of «smart cities». According to the conducted analysis, the main directions and means of ensuring inclusive aspects of the «smart cities» formation and development have been identified. As a result, the consistent implementation of these tasks of a smart city formation will make it possible to fully ensure the main principles of a smart city: efficiency, inclusiveness and sustainability.*

*Keywords: Principles Of Smart City Formation; Universal Design; Accessibility; Inclusive Strategy; Resource-Saving; Energy-Efficient Technologies; Renewable Energy.*

**Problems of the modern state of smart cities.** Around the world, urbanization continues to form the way people live. More and more of the world's population is moving from rural areas to cities.

Currently, half of the world's population lives in cities - by 2030, this number may increase to 5 billion. According to UN forecasts, by 2050 about 70% of the world's population will live in cities (currently about 56%), more than 65% of global GDP is generated in cities. To cope with such growth, it is necessary to find ways to protect the safety of citizens and improve the quality of life while using financial resources more efficiently.

Modern concepts of integrated «smart» cities include spatial (infrastructure), social (equality of rights and involvement), information and economic (employment) components. However, issues of an inclusive approach in smart city planning are considered individually and/or by default.

A smart city is about harnessing the potential of technology and innovation (resource-saving, energy-efficient technologies and renewable energy) along with other resources to more effectively promote sustainable development and ultimately improve the quality of life of its citizens (of all population stratum).

The idea is that smart cities are not just a political tool, but an active collaboration to make our cities sustainable for new generations, and together we improve the quality of our lives under the conditions of inclusiveness of all levels and types of space.

An analysis of the leading world trends shows that now, mainly, the focus of the «smart city» is on connecting devices to improve the lives of city residents in a broader sense. They combine low-power sensors, wireless networks and intelligent analytics using the Internet of Things (IoT) to provide real-time city data and use this information to optimize all urban life: from public safety to transport, energy, water - harvesting and waste management. In essence, the Smart City complements the Safe City as a more comprehensive initiative. IDC predicts that global smart city spending will reach \$189,5 billion by 2023, a significant jump from \$14,85 billion in 2015.

In a smart city, people, data and devices can be connected to create the best place to live. Not a few people are now developing scalable and flexible solutions based on open standards. Using innovative technologies (resource-saving, energy-efficient technologies and renewable energy) and unrivaled expertise, they combine resources to improve productivity in public safety, city traffic and monitoring.

The McKinsey Global Institute (MGI) conducts research on the smart cities development, including under the digital technologies influence, and determines their role in the future life. The McKinsey Global Institute assessed (2018) [14, 15] the smart cities impact that use advanced technologies to solve urban problems. He revealed that smart cities have a positive impact on more aspects of life t quality than

previously thought, including social connectivity, civic participation, employment rates and cost of living. With regard to public health and safety specifically, even in the early stages, smart cities reduced mortality by 8-10%, accelerated emergency response times by 20-35%, reduced the burden of disease by 8-15%, and reduced greenhouse gas emissions gases by 10-15% - making these cities not only more resource-intensive, but also more sustainable. Also, when using digital technologies, it is emphasized (2023) [14, 15] that cyber security is a key factor that ensures trust of IoT networks integration. But ensuring inclusiveness (barrier-free in various directions) in addition to the security functions of smart cities is still not fully resolved.

**Analysis of recent research and publications.** Research into the barrier-free environment was carried out by Siri Tilekeraytn, Ron Meis, M.V. Sholukh, L.M. Barmashina, J.S. Rodyk, V.V. Kutsevich, V.O. Azin, and J.V. Hrybalskyi.

A significant contribution to the «smart cities» concept development was made by prominent foreign scientists as the Austrian scientist R. Giffinger, the American analyst D. Ushburn, the American economist R.E. Hall, British researcher J. Hartley, Italian scientist P. Lombardi, Spanish scientist A. Monzon, Romanian researchers M. Eremia, M. Sandulek, L. Toma, Turkish scientist A. Karaglu, etc.

The work of domestic researchers is dedicated to the study of the SMART-city concept prospects applying to solve the tasks of urban life spheres development among which the works of scientists as M. Akaheev, A. Andrienko, M. Boykova, L. Zhilinska, G. Kucherova, O. Tarasevich and others.

Among the leading scientific and expert institutions of various countries of the world and international organizations and structures, the following should be noted, which are engaged in researching this issue at the global level. Researchers from the leading analytical institution Deloitte touch on the issues of «smart cities» creation and functioning. Juniper Research and McKinsey Global Institute explore the benefits of «smart cities» and services for residents, etc. At the level of the European Union, the European Commission and the Vienna University of Technology deal with the problem of the «smart cities» network systematic formation.

**Materials and methods.** While conducting the research, the integrated basics approach, the simulation mode, theoretical methods of analysis, synthesis, generalization, and abstraction techniques have been applied.

**Goal of research.** The aim of this work is to determine the inclusive aspect of «smart cities» system formation.

**Results. Basic prerequisites of the inclusive aspect of «smart cities» system formation.** The concept of «smart cities» as a whole has already been developed, but it is constantly being improved and deepened, in particular in terms of the conceptual apparatus interpretation. Thus, the Ukrainian Institute of the Future «Ukraine 2030E -

a country with a developed digital economy» defines that the concept of «smart city» is a city model based on the full-scale of digital technologies use to eliminate the current city problems, its sustainable development and improve the citizens life quality [21]. Portuguese and Spanish researchers emphasize that the «Smart City» concept is intended to solve these problems by identifying new and intelligent ways of managing the complexity of urban life and implementing solutions for multidisciplinary problems ranging from energy consumption, resource management, environmental protection, security, quality of life, urban operation efficiency and the wide services range availability [24, 25].

Elements of inclusive space in a smart city, but in the context of technologies (see Fig. 1), are considered by European researchers. According to them, an ecological environment and an efficient urban center of the future should be equipped with developed infrastructure, such as sensors, electronic devices and networks, which stimulate sustainable economic growth and a high quality of life [15, 17].

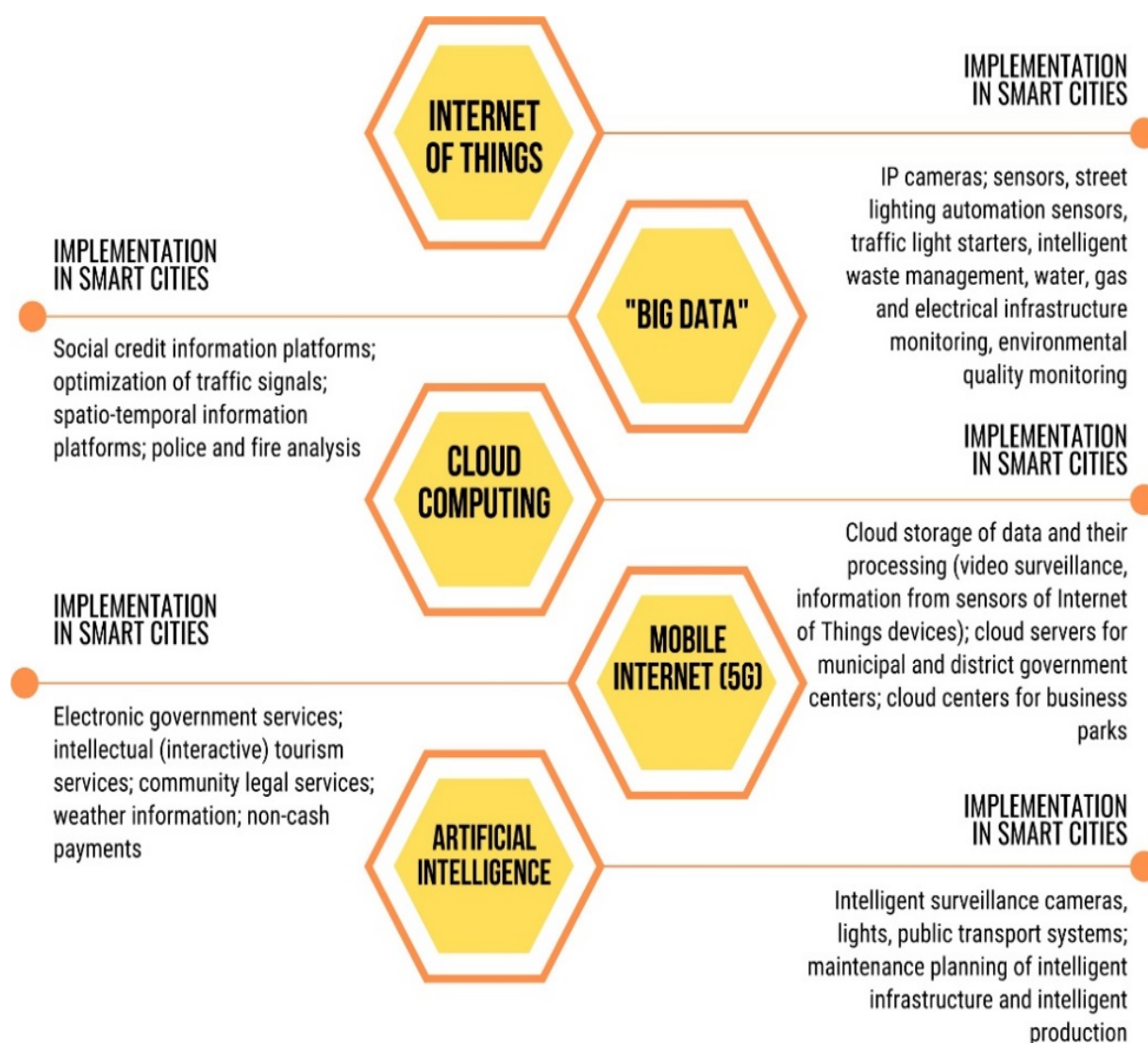


Fig. 1. The main means of smart cities formation.

Also, smart mobility (accessibility, sustainable transport system) and smart environment in a smart city are explored in the works of Öberg, C., Graham, G. and Hennelly, P. [18]. However, according to the authors, the inclusive aspect should be systematically considered at all levels and stages of smart city planning.

A good example of the inclusive smart city system formation is Denmark. The Copenhagen infrastructure project «Connecting Copenhagen» (Connecting Copenhagen) is recognized as the best «smart city» project in the world. Important here is the municipal strategy, which consists of four or three thematic blocks: a good start in life for children and youth; inclusive labor market; coverage of vulnerable groups and areas; economic and social involvement.

A responsible municipal structure is defined for each thematic block. It is important that inclusiveness is understood here as a sphere of joint authorities and citizens responsibility [2].

Local strategies are a common tool for physical and digital inclusion / accessibility implementing in Canada as well. Universal design is paid considerable attention by local institutions of higher education not only in their scientific publications and presentations at conferences (the All-Canadian Conference on Universal Design in Education), but also by testing the guidelines and principles of universal design in the educational process in the specialized Research Center for Inclusive Design and the Institute for Inclusive Design. A thematic web portal was created to popularize best practices in the universal design of physical infrastructure, virtual environments, industrial products, and relevant educational initiatives [20].

**Classification features of «smart cities» taking into account the inclusive aspect.** A *smart city* must meet the *following* conditions:

- sustainable and harmonious economic, social and environmental development;
- optimal natural resources management with citizens participation;
- citizens and institutions devoted to the city;
- infrastructures and institutions equipped with technological solutions that facilitate citizens life of all segments of the population [18].

*Key features of a smart city:*

- intelligent traffic management systems;
- a reasonable approach to street lighting;
- involvement of city residents in management;
- smart house;
- city wi-fi network implementation;
- reasonable and accessible public transport;
- notification of emergency situations;
- emergency response buttons taking into account inclusive design [18].

Thus, the main principles of a smart city are efficiency, inclusiveness and sustainability. These areas should be reflected in the city's development strategy. Inclusiveness principle ensuring requires special.

**Inclusive strategy of «smart cities» system formation.** A reflection of state policy is the creation of an Inclusive Strategy for the systematic formation of «smart city», which, in addition to the basic smart city principles, will also provide for the elimination of barriers in six main directions (see Fig. 2).

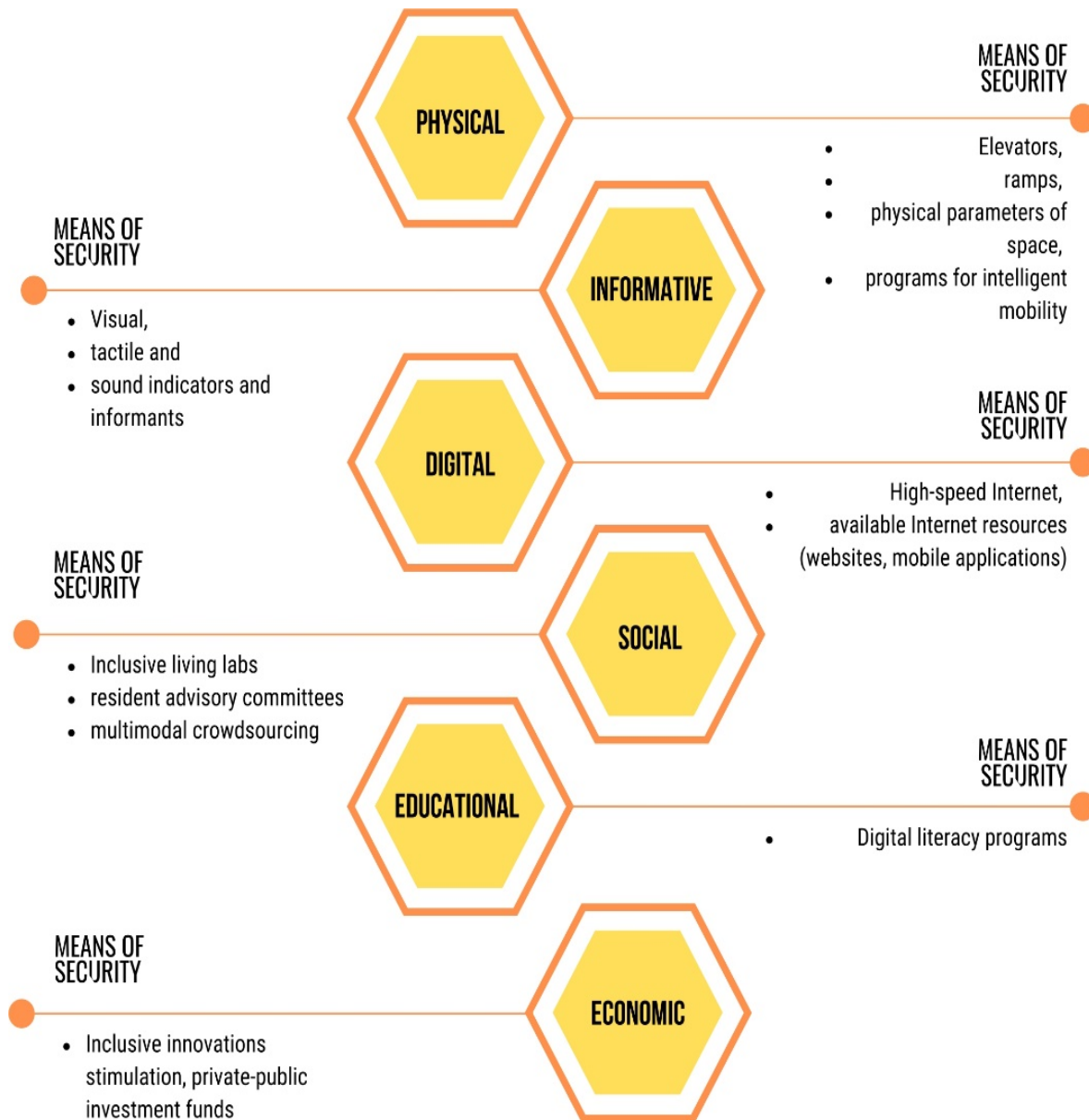


Fig. 2. Means of an inclusive strategy for the «smart cities» systematic formation ensuring.

*The first is physical.* It includes the uniform architectural standards development. This means that the entire environment (buildings, streets, sidewalks, transport) must be physically accessible for all people, in particular for groups with

reduced mobility (people with disabilities, older people, parents with small children, etc.).

*The second is informative.* Within this direction, it is necessary to create conditions under which people, regardless of their mobility, functional impairments or communication capabilities, will be able to access information and use all the necessary technologies.

*The third is digital.* Digital barrierlessness should provide access to all social groups to all online services, and to the Internet itself.

*The fourth is social and civil.* It should provide equal opportunities creation for active participation of people in public life. This means that each person with this approach should feel free in his self-expression, that he will not be judged because of some of his characteristics. And, on the contrary, everyone's difference together will strengthen and develop society.

*The fifth is educational.* Every person should have free access to sound academic background throughout his life.

*The sixth is economic.* And this means to ensure conditions under which a person can get a job and feel protected from discrimination. Also, within this direction should be provided the opportunities creation to obtain financial and other resources in order to engage in entrepreneurship.

**Conclusions.** Therefore, one of the main tasks of the Inclusive strategy for the "smart cities" systematic formation is to create a barrier-free environment for all population groups, to ensure equal opportunities for each person to exercise their rights, to receive services on a par with others by physical, informational, digital, social and civil, economic and educational accessibility integration to all state policy spheres.

Consistent implementation of this task of smart city formation will give every person the opportunity to:

- get unhindered access to the physical environment objects;
- to receive information in the most convenient way;
- get simplified access to digitized and analog state and social services;
- to obtain equal conditions of participation in all society spheres;
- to obtain conditions and equal opportunities for physical education and sports;
- to obtain equal conditions and opportunities for cultural (artistic) and/or creative expression, carrying out cultural activities; access to cultural services, cultural values, cultural heritage and information about them;
- participate in political processes and public activities;
- get equal opportunities and free access to education;

- to obtain equal conditions and opportunities in the field of employment, as well as entrepreneurship.

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## **ІНКЛЮЗИВНИЙ АСПЕКТ ФОРМУВАННЯ РОЗУМНОГО МІСТА**

У роботі визначено основні питання формування розумного міста з урахуванням демографічних, просторових, соціальних, інформаційних та економічних факторів. Також узагальнено досвід провідних світових трендів щодо засад формування «розумних міст» для забезпечення збалансованого економічного, екологічного, соціального та технологічного розвитку міст. Визначено основні технології розвитку «розумних міст» (ресурсозберігаючі, енергоефективні технології та відновлювана енергетика), з визначенням ключових технологій інклюзивного напрямку. Розглянуто основні передумови інклюзивного аспекту формування «розумних міст» та їх основні ознаки. «Розумне місто» розглядається як таке, яке відповідає поточним потребам громадян у різних аспектах їхнього життя. Проектування таких поселень наразі є одним із пріоритетних напрямів політики світу. Визначено, що розвиток і

формування розумних міст має бути нерозривно пов'язане з розробкою та впровадженням Інклюзивної стратегії системного формування «розумних міст». За результатами проведеного аналізу визначено основні напрями та засоби забезпечення інклюзивних аспектів формування та розвитку «розумних міст». Як наслідок, послідовна реалізація цих завдань формування розумного міста дозволить повною мірою забезпечити основні принципи розумного міста: ефективність, інклюзивність та сталість.

Ключові слова: принципи формування розумного міста; універсальний дизайн; доступність; інклюзивна стратегія; ресурсозберігаючі; енергоефективні технології; відновлювана енергетика.

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