



STANDARDIZATION IN THE FORMATION OF SCIENTIFIC AND METHODOLOGICAL FOUNDATIONS OF SMART CITIES

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Annotation

This article is devoted to the analysis of the goals, structure and requirements, as well as the formation, role and importance, tasks and structural components of smart cities. The issues of the stages of development of smart cities, the measures being taken to improve them to achieve the improvement of urban infrastructure, as well as the experience of modern cities in the world with the aim of an effective urban management system, to create decent conditions for the population of cities, are highlighted.

It is substantiated that the standards define a list of target indicators, the measurement and control of which allows cities to assess their development, the use of standards helps to quantitatively measure the state of various areas in cities and identify problem areas to create an effective infrastructure for modern smart cities. The analysis of ISO standards reflecting the work in different directions is given: improving the quality of services, the efficiency of urban infrastructure. The main foreign organizations involved in the development of smart city standards and the requirement for standards are given. Concepts are given for the index of sustainable development of cities. Based on the results of the analysis and research, conclusions and recommendations are formulated.

Keywords: smart city, smart city infrastructure, urban digital system, concept of smart cities, quality of urban resource management, standard, British Standards Institute, sustainable urban development index, urban environment, international standard, construction.

INTRODUCTION

The rapid growth of the urban population causes many technical and infrastructural problems that threaten to lose functionality and turn cities into territories less suitable for a quality life of the population.

In addition, social problems come to the fore, the solution of which requires the involvement of society as a whole. In this regard, cities need innovative and organizational mechanisms to solve a wide variety of problems. Research and analysis of approaches and ways to solve the infrastructure of a "smart city" seems to be relevant for our cities as well.

Modern cities are like living organisms with a large number of vital organs: the heart of the city is its inhabitants, the brain is local authorities, and the nervous system is communication systems. Each organ must interact properly with each other for the health of the whole organism.

It was from this concept that the idea of a "smart city" was born - a city in which it is comfortable to live, grow and work.

In order to create decent conditions for improving the standard of living, solving urgent problems of citizens, improving social infrastructure and developing regions, the Cabinet of Ministers of the Republic of Uzbekistan adopted Resolution No. 48 dated January 18, 2019 "on approving the concept of introducing Smart City technologies in the Republic of Uzbekistan".

To date, Uzbekistan is at the initial stage of introducing innovative technologies "Smart City". The implementation of pilot projects for the implementation of Smart City technologies in the city of Tashkent has begun in the areas of Safe City, Smart Meters, Smart Transport, Smart Medicine. Comprehensive work is being carried out to introduce modern urban infrastructure.

At the same time, one of the main problems hindering the effective implementation of Smart City technologies is the underdeveloped infrastructure of information and communication technologies and the significant deterioration and obsolescence of urban infrastructures.

USED MATERIALS AND METHODS

"Smart city" is (from the English smart city) the concept of integrating several information and communication technologies (ICT) and the Internet of things for managing city property, which simplifies the management of internal city processes and improves the standard of living of the population.

The goal of creating a "smart city" is to improve the quality of life through urban digital transformation technology to improve overall service efficiency and meet the population's need for urban infrastructure.

Smart city features:

- Smart economy:
- Smart control:
- Smart finance:
- Smart infrastructure:
- Smart residents:
- Smart environment:
- Smart technologies:

The term "smart city" was introduced relatively recently, and there is still no unambiguous interpretation of this concept.

The concept of smart cities was formed in the early 2000s. Period 2008-2012 can be described as "Smart City 1.0", where the main attention was paid to certain scenarios for the use of technologies and B2G class decisions (business-to-government - relations between business and government) were adopted.

After 2016, a new period in the development of smart cities begins - "Smart Cities 2.0", where the comfort of residents comes first, and information technology becomes only a means to create it.

A coherent smart city development plan has four/three (the first is just a preliminary check) key components:

1. Establish what a community is. Perhaps it is this setting that will determine what needs to be done in the next steps;
2. Study the community. Before making a decision to create a "smart city", it is necessary to understand why it is needed.
3. Develop a Smart City policy.

4. Involve all participants in the city's infrastructure.

Smart city - an intelligent city performs two important tasks:

- collection and transmission of data to management representatives;
- Establishment of feedback between the administration and citizens, improvement of the environment.



Bletchley Park is often considered the first smart community.

Street lights in Amsterdam have been upgraded to allow dimming for use in pedestrian areas.

The advantages of a smart city are to increase the standard of living of citizens and to reduce the costs of work processes due to the automation of activities.

RESULTS AND DISCUSSION

Why smart cities are the future? Now all over the world there are not so many smart cities in the global ratio, while the creation of a smart city is a labor-intensive process that affects all layers of infrastructure. There are two reasons why the growth of smart cities is unstoppable:

- The need to develop new profitable resources;
- Urban population growth. Up to 70% of the world economy is concentrated in cities. Therefore, the concept of a smart city of the future is so popular - it is becoming the main tool for managing the economy in developed countries. Today, approximately 60% of the world's people live in cities, and this figure is on the rise.

- If it's so profitable, why does it take so long for cities to get smarter? The reason why smart megacities are not yet sprouting across the planet like mushrooms after rain is that there is no single system for collecting and analyzing data in the world. Information is collected by too heterogeneous devices - navigators, smartphones, search engines.

- The second reason is the lack of necessary capacities. The development of smart cities requires considerable costs and the use of modern equipment, and the latest servers are needed to store big data. However, scientists are sure that progress will inevitably lead to the fact that smart settlements will become a common trend.

- "Smart City" is aimed at increasing the competitiveness of cities, the formation of an effective urban management system, the creation of safe and comfortable living conditions for citizens and is based on 5 key principles:

- orientation to the person;
- manufacturability of urban infrastructure;
- Improving the quality of urban resource management;
- comfortable and safe environment;
- emphasis on economic efficiency, including the service component of the urban environment.

The main tool for the implementation of these principles is the widespread introduction of advanced digital and engineering solutions in urban and municipal infrastructure.

Urbanist Anthony Townsend is sure that "smart cities" are not a system, but a tool. That is, such cities do not have a single structure, they are constantly being transformed in order to become more practical and comfortable for life.

In Almaty, for example, there is a WeAlmaty platform where any resident of the city can share ideas for improving it, exchange knowledge with experts in various fields, and learn social leadership. And most importantly - to contribute to the development of the city.

There are about 165 smart city projects in the world, which are located on almost every continent - from Latin America to Oceania.

For the first time, "smart cities" appeared in Europe, however, the concept began to spread rapidly to other countries of the world. Британский институт стандартов (British Standard Institution, BSI) описывает умный город, как «эффективную интеграцию физических, цифровых и человеческих систем в искусственно созданной среде с целью обеспечить устойчивое, благополучное и всестороннее будущее для граждан».

Singapore's experience is important in creating a safe and comfortable urban environment, improving the quality of urban services and the lives of citizens. Many cities are actively adopting the standards for education and health adopted in a unique city-state.

In London, the fire department uses socio-demographic data to assess and prevent fire risks.



- In the Australian capital, the SCATS system is used to determine the degree of congestion of highways.

- Monitoring the state of the urban atmosphere is another strong point of Sydney. 14 sensors have been installed here, which collect data on the state of the air around the clock. Based on these data, a special algorithm calculates the air quality index (AQI - air quality index).

Madrid is one of the five most densely populated municipalities in Europe. Madrid is using IBM Smarter Cities technologies to improve municipal waste management.

The Sustainable Urban Index is a new tool that captures five dimensions of sustainable urban growth. Many states are striving for sustainable development, that is, economic growth that improves the quality of life without harming the environment and natural resources.



New systems of indicators have been developed - the so-called index of sustainable urban development. This index quantifies the growth dynamics of cities according to the following five criteria:

- the degree of satisfaction of the basic needs of the population;
- efficient use of resources;
- cleanliness of the environment;
- urban infrastructure;
- focus on sustainable development in the future.

The index makes it possible to quantify the dynamics of urban growth based on a universal set of parameters.

Consider the manifestations of standardization of management systems in the technology of "smart cities".

The standard in essence is a generalization of the best practices in a particular field of activity, which have the potential for universal application. The first standard ISO TS 268 (sustainable community development) was created in 2012.

Intensive processes of searching for and describing best practices for the purpose of their subsequent transformation into standards both at the national levels and in regional and international organizations (Table 1).

The British Standards Institute and the International Organization for Standardization are leaders in the accumulated knowledge in the field of smart city standardization. In 2014-2015 ISO standards have been developed that state that there are three levels of projects: infrastructure level, facility level, and urban service level.

The standards define a list of target indicators, the measurement and control of which allows cities to assess their development. ISO 37120:2014 Community sustainability. Indicators of urban services and quality of life" regulates 46 mandatory and 56 auxiliary indicators in 17 areas.

Standard ISO 37151:2015 "Intellectual infrastructures of public utilities. Principles and Requirements for a Performance Scorecard" contains a methodology for assessing the performance of smart city utility infrastructure in 14 categories of basic community needs (from the point of view of residents, managers and the environment).

The collection of data from cities and their analysis is carried out by the international organization of the World Council on City Data World Council on City Data (WCCD), which performs the functions of certifying cities in accordance with ISO standards.

The use of standards helps to quantify the state of different destinations in cities and identify problem areas. By leveraging data-driven decision making, cities are improving key metrics and strengthening their position on the global WCCD registry.

ISO standards metrics reflect work in different areas: improving the quality of services, the efficiency of infrastructure and individual facilities. This involves the optimization of power supply systems, water supply, public transport, lighting, etc., which requires the integrated use of analytics.

Along with the geographical, the typology of standards is represented by three categories: strategic, managerial and technical.



Strategic standards algorithmize the creation of strategies, plans and goal setting for smart cities. The main attention is paid to improving the mechanisms for making managerial decisions.

Process standards provide development methods and guidelines for sharing information between organizations and citizens in a city, and classifying data for informed decision making.

Technical standards are recommendations for the development of digital infrastructure of smart cities (communication channels, Internet protocols and sensors).

Table 1

The main foreign organizations involved in the development of smart city standards

No	Organization // Smart City Division	Activity Focus
International		
1	International Electrotechnical Commission (IEC) // Systems Evaluation Group (smart cities)	Three levels of technical standardization processes: standardization evaluation groups, system committees, resource groups
2	International Organization for Standardization (ISO) // TC268/SC1	Requirements, guidelines and recommendations related to the achievement of the goals of sustainable development of cities and settlements
3	ISO/IEC // Joint Tech. Committee 1	International ICT standards
4	International Telecommunication Union (ITU) // Focus Group on Smart Sustainable Cities	Knowledge sharing platform to create a standardized system for the implementation of ICT in smart cities
Regional		
5	European Commission // European Innovation Partnership on Smart Cities	Smart City Guidance Package (recommendations for planning and creating "smart cities"). AENOR.
6	European Standardization	Coordination of activities of European

	Organizations // Smart and Sustainable Cities and Communities Coordin. Group	standards organizations (CEN, CENELEC and ETSI). Collaborates with ISO, IEC, ITU
7	Institute of Electrical and Electronics Engineers (IEEE) // IEEE Smart Cities	P2413.1 - Smart City Reference Architecture Standard. R2784 - Guidelines for creating a smart city planning system. 150 smart city technology standards
National		
8	National Agency for New Technologies, ENEA (Italy) //Cyber-Physical System NIST, Consip, Confindustria	Applied standards (data compatibility). Coordination of Italian cities and organizations under the NIST program

No	Organization //Smart City Division	Activity Focus
9	AENOR (Spain)	UNE National Standards: 178301 Open Data, 37120 Sustainable Urban Development, 178501 and 178502 Smart Tourist Places, 178105 Accessibility for All, 178402 Smart Ports
10	British Standards Institution, BSI (BSI// Cities Standards Institute	Issues its own smart city standards
11	VDE (Germany) // Strategic Group for Smart Cities (Strategiegruppe zum Thema Smart Cities)	Released a compilation on standardization "Standardization Roadmap Smart City" in 2014.
12	NIST (USA) // GCTC, SCCF, Cyber-Physical System program	Global City Teams Challenge (GCTC), Smart Cities and Communities Framework (SCCF) - platforms. Cyber-Physical System - Standards
13	ANSI (CIIIA) // ANSI Network on Smart and Sustainable Cities	Global platform for discussion and exchange of experience on standards and sustainable cities

ISO standards (many of which are based on BSI standards) are aimed at qualitative changes in management, the introduction of new technologies to improve the resilience of the city in the areas of energy, transport, public infrastructure, security and health.

BSI standards do not apply the classical sectoral approach to the perception of the urban environment (division into the areas of ecology, management, electric power industry) (Table 2).

table 2

Comparative typology of individual 150 and BSI standards

Standards	ISO	BSI
Strategic	<p>ISO 37100: Sustainable development & resilience of communities - Management systems - PDCA cycle and sustainable development goals.</p> <p>ISO 37101: Sustainable development in communities - Management system for sustainable development - requirements for a management system in cities.</p> <p>ISO 37104: Cities guidance - recommendations for building sustainable societies.</p> <p>ISO 37150 and ISO 37152: Smart community infrastructures - analysis of soft and hard infrastructures of a smart society</p>	<p>Aimed at creating management systems with the involvement of citizens and the creation of p2p projects.</p> <p>PD 8100: Smart city Overview - actions for the rapid implementation of the "smart city" concept. PD 8101: Smart city Planning - A guide to planning infrastructure projects. Oriented for use by local governments. PAS 181: Smart city Framework - best practices for managing, making decisions and developing smart city strategies</p>
Process	<p>ISO 37151: Smart community infrastructures - Principles and requirements for performance metrics - Smart city indicators.</p> <p>ISO 37104 Sustainable cities and communities - Transforming our cities - Guidance for local implementation of ISO 37101 - Guidelines for the application of ISO 37101.</p> <p>ISO 37106 Sustainable cities and communities - Guidance on establishing smart city operating models - Methods for developing a city model for citizens</p>	<p>PAS 180: Vocabulary - general smart city terminology. Improves communication and understanding between developers, designers, equipment manufacturers and consumers in smart cities.</p> <p>PAS 182: Smart city Data Concept Model - classification of information from multiple sources and their integration into a database. Smart city concept model (SCCM)</p>
Technical	<p>ISO 37120: Sustainable development of communities - Indicators for city services and quality of life - indicators for assessing services and quality of life.</p>	<p>PAS 212 Automatic resource Discovery for IoT - protocol for automatic discovery of data stored on any compatible server</p>



Standards	ISO	BSI
	ISO 37122:2019 Sustainable cities and communities - Indicators for smart cities ISO/IEC 30182:2017 Smart city concept model — Guidance for establishing a model for data interoperability — Concepts (society, metrics, services, resources) and links between them	

The considered standards are fundamental for building smart cities, while reforming the management system is a key link and is closely related to digital innovation, economic growth, resource efficiency and infrastructure.

Standardization of solutions to the concept of "smart cities" is the most important methodological direction aimed at identifying the general patterns of development of this phenomenon in the modern world.

CONCLUSIONS AND RECOMMENDATIONS

An important task of urban planning for the creation of smart cities is to conduct an in-depth analysis of the most rational solutions on this issue, implemented in foreign countries, and their practical approbation in laboratory and field studies and within the framework of relevant pilot projects.

The introduction of smart city technologies increases the efficiency of city management by creating a unified digital environment that allows you to manage the city as a whole.

The analysis shows that today the legal and regulatory environment governing the mechanisms for the use of "smart cities" and schemes for subsidizing measures for the digitalization of the urban economy is rather poorly developed.

Due to the complexity and versatility, the solution of existing problems is possible with the presence of a coordinating control center for the creation of smart cities" of responsible authorities, while the role of such an authority is seen as follows:

provision of a regulatory framework for the accelerated and effective implementation of the planned activities, taking into account the positive international experience achieved.

Creation of new leading smart city standards, modernization of previously released smart city standards. According to BSI rules, this happens at least once every two years. Since almost all smart city standards were released in 2014-2015, taking into account the new conditions, they should be reviewed and improved taking into account subsequent experiences in creating smart cities.

The development of smart city standards encourages the intensive formation of global smart city consortiums to develop a common vision of how cities should be run and solve urban problems.

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