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SMART CITIES: POSITIVE EFFECTS AND PROBLEMS OF INNOVATIVE TECHNOLOGIES IMPLEMENTATION

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Abstract. *The article is devoted to the key components of the implemented technologies of the «smart city» in the functioning of modern megacities. As a research task, the authors defined an attempt to identify problems arising from the introduction of innovative technologies into the city performance. The necessity of an integrated approach to the development of a strategy to solve them is validated.*

Keywords: *smart city, development strategy, sensor overload, data protection.*

According to UN estimates, by 2050 the number of urban population will amount 70% of all inhabitants of the planet, the number of which by this time will account for about 10 billion people. Modern megacities are becoming hostages of their success – the growing population absorbs the remaining corners of greenery, produces megatons of waste, the existing sewage systems do not cope with the annually increasing load, the damage from natural disasters on the territory of megacities increases tenfold due to dense building up – the list of problems can be continued. In the era of digitalization, the idea of «smart cities» of the future seems to be a potential recovery from many problems and is becoming a reality. Digital technologies created to improve the quality of life of the population of cities, regardless of the number of residents in them, used in the framework of the «smart city» concept, provide easy access of citizens to urban infrastructure information systems for transport, health care, education, public utility and other services. They also allow the city authorities to interact on-line with the structural elements, monitor the development of the city and, based on the analysis of

the data obtained, timely generate management decisions aimed at improving the interaction of all components of city's functioning.

The functional areas in which the newest technologies of optimization, distribution and saving of resources and finances of smart cities are applied, are as follows:

- education
- energy saving
- environmental protection
- places of rest and recreation
- security
- waste management
- telecommunications and communications
- financial management
- fire safety and emergency situations
- e-government
- health care
- transport
- city development planning
- water supply, sewage
- sanitation.

Components and functional areas of «Smart City» projects are:

Video surveillance and video analytics

Photo and video recordings

Situation centers

ITS – intelligent transport systems

Safety on public transport

Professional radio and broadband access (LTE, 5G)

IoT – Internet of Things

Biometrics

Unstructured Data Processing

Decision Support Technologies

Augmented and Virtual Reality

Distributed Databases

Geoinformation technologies and navigation

Machine learning

Cloud / Fog / Boundary Computing

Currently, practically all the major cities of the world implement programs as part of their strategies to transform their cities into «smart cities». According to Roland Berger, European consulting company, 153 cities in the world have an officially approved, openly published «smart city» development strategy, 15 of them have an integrated strategic approach, and 8 of them demonstrate significant success in their implementation from 2017 to 2019 years.

Researches of organizations and private consulting companies showed tendencies to diversity in implementation processes between cities, even those that follow the same plan. However, research has revealed a number of specific practices that have been adopted in successful intellectual cities and, apparently, can be equally useful for everyone. In particular:

In successful cities, open and transparent rules governing the use of data (on which the functioning of any intelligent city depends) by government agencies and outside organizations, both in free exchange and monetization in order to cover the costs of data management, are applied.

Many cities that are far advanced in the creation of intelligent urban systems are constantly striving to make information and communication technologies (ICT) and IoT (Internet of Things) infrastructure accessible to users both from and outside the city administration, and they manage to avoid scattering in information resources of different departments.

Government agencies (and their outside partners), which are actively working to attract citizens to the implementation of initiatives to create an intelligent city, have achieved

very high efficiency. This is especially true for initiatives where the benefits are most obvious, such as the setting of intelligent lighting systems or intelligent parking.

The infrastructure of an intellectual city must be scalable to allow the possibility of growth and development in accordance with future needs, and ensure reliable protection of data of state bodies and individuals.

Those cities that have chosen outsourcing companies as technology partners, are able to provide the necessary scale of innovation and have opportunities for investment and experience in solving real tasks, along with open technology platforms that allow to avoid dependence on a particular supplier, will receive maximum benefits.

It is vital to develop strategies to better meet the needs of a growing urban population. During the evolution of intelligent cities, the ICT and IoT intellectual platforms will play an indispensable role. Many cities are already using these technologies to optimize infrastructures and services, make well founded decisions, stimulate economic development and social relations, and create more secure and environmentally friendly communities, while expanding the range of public services.

Jeremy Green, a leading analyst at Machina Research and the author of the Scenarios for the Development of Intelligent Cities, wrote that no one says that turning a city into an intellectual one is a simple task. There are many choices to make. Technology and business models are evolving rapidly, and this leads to uncertainty in many aspects. Standards are already beginning to appear, but their creation is still very far from complete. Therefore, there is no simple way to provide intellectual capabilities [8].

However, the rapid development of practical innovative solutions needs to be streamlined and controlled by the management of countries and regions. It becomes obvious the need to develop strategies and criteria for assessing progress in innovation in building «smart cities». The International Organization for Standardization has developed ISO Standards 37120: 2014 and 37151: 2015 2014-2015, in which it is noted that there are three levels of projects for the development of intelligent cities: the infrastructure level, the level of facilities and the level of urban services.

The standards define a list of targets, the measurement and control of which allows cities to evaluate their development. ISO 37120: 2014, «Sustainable community development. Indicators of urban services and quality of life» regulates 46 mandatory and 56 auxiliary indicators in 17 areas.

Standard ISO 37151: 2015 «Intellectual infrastructure of public utilities. Principles and requirements for the system of performance indicators» contains a methodology for assessing the performance of the municipal infrastructure of smart cities in 14 categories of the basic needs of the community (from the point of view of residents, managers and the environment protection authorities).

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

The use of standards helps to quantify the status of various areas in cities and identify problem areas. Using data-based decision making, cities improve key performance indicators and strengthen their position in the international WCCD registry.

ISO-standards metrics reflect the work in different directions: improving the quality of services, efficiency of infrastructure and individual objects. This implies the optimization of energy supply systems, water supply, public transport, lighting, etc., which requires the integrated use of analytics.

There are also alternative methods for evaluating the development of smart cities, among them the criteria system of the international consulting company Roland Berger and the international research bureau of The Economist Intelligence Unit.

The development of smart cities seems to be an absolute good, but recently critical articles have appeared in the media and in the scientific literature pointing out the shortcomings of developing smart city systems. First of all, it means sensory overload. Smart cities are based on data. Sensors are needed so that with their help the platform could combine all the data and use them to make (or offer) decisions at speeds exceeding human capabilities.

Sensors will measure temperature, driving patterns, pedestrian traffic, air quality and infrastructure integrity (for example, is the bridge safe?), and much more. Lux Research, a research and innovation advisory firm, reports that the world will have 1 trillion sensors installed by 2020.

With the existing energy paradigms, it is impossible to power 1 trillion devices, not to mention a million in one city. Currently, projects are being developed for wireless sensor power supply.

But large data sets themselves are not a panacea for all the ills of a big city. There are practical questions: how traffic during peak hours can be reduced based on data? How to reduce the amount of vehicle emissions in the air? Where do contaminants come from and how can it be stopped? How can be prevented the contamination of meat at a nearby food processing plant, which will cause the detriment of residents' health of the entire city?

As smart cities develop on the basis of data, their mass aggregation will establish some truths about how cities work. To interpret and use this data, the necessity will arise to have control personnel with a level of training that modern educational institutions cannot provide. This will lead to the emergence of a new type of inequality depending on the level of education, the level of access to data use, the level of skills to use technology, which further marginalizes the part of the population that is employed in the service sector, small business, farms, etc. The so-called «digital inequality» can become a large complex of problems that affect the rights of citizens, freedom of speech and their participation in democratic politics. These issues should be high on the agenda of national smart cities, which should find ways to encourage broader efforts by governing bodies to interact with marginal citizens.

One more problem, that worries absolutely all residents not only of smart cities, but also of localities seeking to develop «smart technologies» in their territories, is the protection of data. Cyber wars are becoming part of the modern world, industrial espionage, stealing of personal data of citizens and state secrets have become another area of activity of criminal and terrorist organizations.

Interference in private life is also a problem that is increasingly being paid attention by residents of big cities. The constant presence of cameras and hundreds of sensors in the field of view, even inside their own apartment, negatively affects urban residents and leads to an increasing nervousness of the population.

While it is obvious that smart technology has the power to make lives of people much simpler – especially in highly populated urban areas – implementing that technology must be done in a carefully planned and highly secure manner. Rather than just focusing on what the solution can do, developers, governing bodies and tech companies must also consider how it will affect the people that come into contact with it. Further deep insight and investigations should be performed in order to clarify all possible risks and timely undertake corresponding preventive measures.

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Аннотация. *В статье рассматриваются ключевые компоненты внедряемых технологий «умного города» в жизнедеятельность современных мегаполисов. В качестве исследовательской задачи авторами была определена попытка идентифицировать проблемы, возникающие при внедрении инновационных технологий в функционирование города. Обосновывается необходимость комплексного подхода к выработке стратегии их решения.*

Ключевые слова: *умный город, стратегия развития, сенсорная перегрузка, защита данных.*

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TUBULAR ROTATING FURNACE FOR KAOLINS BURNING AS A CONTROL OBJECT

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Abstract. *The furnace for firing high-alumina raw materials and producing kaolin as an object of automatic control is considered. The article analyzes input, output and disturbance effects. Tubular furnace is presented in the form of 5 zones, each mass transfer coefficient being assumed to be constant.*

Key words. *Firing high-alumina raw materials, kaolin, tubular rotating furnace, control object.*

The firing of high-alumina raw materials in tubular rotary kilns is one of the main operations of the production technology of mullite-corundum refractory products, which largely determines its technical and economic indicators. Therefore, the improvement of the operation of these furnaces to stabilize the quality of the product, reduce the specific heat loss and extend the furnace campaign life-time is of practical importance. These issues can be solved most effectively on the basis of expanding