Geography

INNOVATIVE URBAN DEVELOPMENT: THE CONCEPT OF "SMART CITY" AND ITS IMPLEMENTATION IN THE U.S.

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Along with the rapid development of information and communication technologies in the 21st century, implementation of innovative urban development practices and approaches has become a pivotal trend and direction of contemporary urbanization process. Smart cities are considered to be the main practical outcomes of innovative urban development. Meanwhile, the concepts of "smart city" and sustainability are mutually connected and determined: thus, the concept of "smart sustainable city" has emerged to characterize the use of smart and innovative urban technologies for achieving long-term and balanced urban development in socio-economic, institutional, cultural, and environmental aspects.

Innovative urban development gets a particular significance for the U.S., taking into account the great share of country's urban population (above 80%), distribution of large and densely-settled urbanized areas across the country, as well as the uniqueness of the factor of urbanization in American lifestyle, economy, and social relations.

The theoretical section of this paper is devoted to the study of aforementioned theoretical ideas and peculiarities of innovative urban development smart sustainable cities. It is followed by a practical section, where relevant cases of 5 American smart cities (New York City, San Francisco, Columbus, Austin and Chicago) were studied, compared and summarized.

Introduction. In recent years, implementation of innovation-based approaches and solutions (urban innovation systems) is among the most perspective and key features of urbanization processes, resulting in innovative and sustainable urban development and creation of smart cities. In turn, smart cities practice advanced technologies like the Internet of Things (IoT), data analysis and connectivity to increase the efficiency of different aspects of urban life such as transportation, traffic, energy and resource management, healthcare, public services, etc.

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Urban development in the U.S. has seen significant efforts and practices towards innovative and sustainable urban development and further implementation of the concept of "smart city". It has a crucial significance for the country with around 83% of its total population living in cities (around 275 million people), and hosting large megacities and urbanized areas. Besides, the special socio-economic, lifestyle and cultural significance of urbanization in the U.S. should be mentioned as well.

This paper studies the current state and main types of innovative approaches to urban development in the U.S., focusing on the concept of "smart city" and its implementation. For this purpose, the main theoretical provisions of innovative urban development, smart and sustainable cities were analyzed.

Afterwards, relevant case studies and examples of best practices of successful implementations of smart city initiatives across the U.S.

The Main Outcomes of the Study.

The Main Ideas and Priorities of Innovative Urban Development. In general, innovative urban development refers to the planning and implementation of innovative solutions and approaches (urban innovation systems) aimed at ensuring sustainable, safe and efficient cities and urban areas. Therefore, smart and sustainable cities can be considered as the main outcomes of the process of innovative urban development.

Urban innovation systems can be viewed as systems composed of interrelated sub-systems and components. According to Chen and Xu (2009), urban innovation systems have three main elements: innovation subject, innovation resources, and innovation environment. The most general and accepted idea is that urban innovation systems are composed of the main elements, functional elements, and environmental elements. Main elements are the innovation institutions and organizations connected with innovation, including enterprises, scientific research institutions, and universities. The functional elements are the systems and policies that coordinate the relationships between the elements, such as public services, governmental governance mechanisms, and the financial environment and systems. Finally, environmental elements are related to urban natural ecological aspects: the urban geographic location, materials and resources required for innovation, and environmental quality [1].

An important point is that innovative urban development is much broader than simply using information and communication technologies (ICT) in urban development processes. Besides of the use of ICT, innovative urban development includes the implementation of a great variety of organizational and institutional tools for increasing the effectiveness of all kinds of city operations in general.

Based on the aforementioned theoretical ideas, the following main aspects or priorities of innovative urban development can be identified.

• *Environmental Safety and Sustainability*. An important aspect of innovative urban development is creating cities that are environmentally sustainable. In this regard, innovative approaches may refer to reducing carbon emissions, promoting renewable energy sources, implementing green infrastructure, and encouraging sustainable transportation options, etc.

• *Smart Urban Infrastructure*. This may include IoT devices for monitoring and optimizing resource and energy use, managing traffic flow, preventing congestions, etc.

• *Urban Resilience in Terms of Climate Change, Natural Disasters, and Socio-Economic Disruptions*.

• *Equal and Inclusive Growth*, i.e. promoting such kind of urban development to ensure that the benefits of growth are distributed and shared by all residents in an equal way. This includes affordable housing conditions, access to quality social services (such as education and healthcare), and relevant economic opportunities for everyone.

• *Collaborative and Good Urban Governance*: particularly, engaging different stakeholders (representing the government, business, academic sector and civil society) in collaborative and joint decision-making processes.

The Meaning and the Main Features of "Smart City" Concept. It should be noted that there are not clear and final academic definitions of the "smart city" concept yet. Along with the worldwide use of ICT in urban planning and development, a number of almost identic city labels have been emerged, such as "digital city", "electronic city", "technopolis", etc. However, the term "smart city" can be used as an "umbrella", which generalizes and merges the aforementioned labels of cities.

Meanwhile, it goes without saying that the ideas of innovative, smart and sustainable urban developments are strongly connected. Particularly, implementation of innovative (smart and ICT-based) approaches in cities is contributing to ensuring urban sustainability essentially, promoting the emergence and further development of sustainable cities. Therefore, the concept of "sustainable smart city" is becoming more popular, indicating the usage of digital and ICT-based solutions for improving the quality of life and the environment, as well as the efficiency of urban activities (economic, social, cultural, institutional, etc.). In other words, this concept can be defined as application of innovations for urban sustainability.

In general, a smart city is a locale, where traditional networks and services are made more flexible, efficient, and sustainable with the use of information, digital, and telecommunication technologies. In other words, in a smart city the digital technologies translate into better public services for inhabitants, and for better use of resources with less environmental impact [2].

Locke defines smart cities are municipalities and urban areas that are deploying connected technologies and IoT solutions to improve everything from critical infrastructure and public safety, to efficiencies in city lighting and energy usage, to better traffic flow and mobility – all of which stand to make cities better places to live, work, and play while lowering their carbon footprint [3].

United Nations Economic Commission for Europe (UNECE) and the International Telecommunication Union (ITU) developed jointly a definition of smart sustainable cities as innovative cities that use ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects [4].

Concluding and summarizing this section of the paper, the key performance indicators of smart sustainable cities worked out by UNECE should be presented (see Table).

Key performance indicators of smart sustainable cities [5]

Dimensions	Examples of key performance indicators and activities
Economy	Household internet access, public Wi-Fi availability, water and electricity supply ICT monitoring, dynamic public transport information, traffic monitoring, e-government, shared bicycles and vehicles, public building sustainability, public transport network convenience, small and medium size enterprises, etc.
Environment	Air pollution, greenhouse gas emissions, drinking water quality, water consumption, wastewater and solid waste treatment, noise exposure, green areas, recreation facilities, renewable energy consumption, etc.
Society and culture	Student ICT access, higher education degrees, adult literacy level, life expectancy, electronic health records, health insurance and public health coverage, cultural infrastructure, poverty share, Gini coefficient, voter participation, etc.

Case Studies and Success Stories of Smart Cities Development in the U.S. The development of smart cities in the U.S. has raised during the last decade significantly. Nowadays, different cities are practicing a variety of innovative urban solutions and technologies. From around 20 most well-known cases the following 5 cases of smart cities will be discussed below: New York City (New York), Chicago (Illinois), San Francisco (California), Austin (Texas) and Columbus (Ohio). These locales were chosen in order to include different geographical regions of the U.S.: Atlantic (East) Coast, Midwest, Pacific (West) Coast and South. Besides of these 5, the more complete list of American smart cities normally includes Dallas (Texas), Seattle (Washington), Charlotte (North Carolina), Washington D.C. Boston (Massachusetts), Pittsburgh (Pennsylvania), Boulder (Colorado), San Jose (California) and other cities.
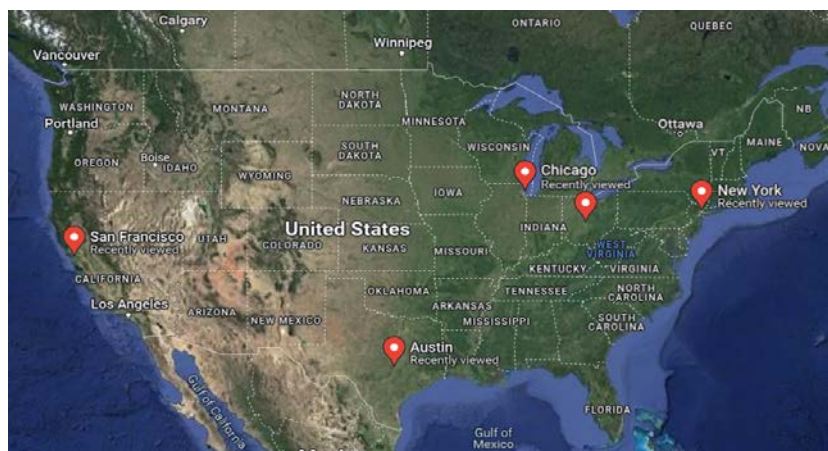
Locations of 5 cases of smart cities to be discussed (https://google.com/maps).

New York City (New York). With a population number of around 8.5 million (and above 20 million within New York metropolitan area), New York is the largest city in the U.S., as well as the most densely populated urban area in the country. Thus, implementation of smart and next-generation approaches gets a special importance for New York City.

From the variety of solutions, the LinkNYC smart city initiative includes high-tech city kiosks offering a fast and free public Wi-Fi, electronic device charging facilities and access to different city services. Besides, the Big Apple's smart city initiatives include water usage monitoring and management and waste management through smart sensors, as well as traffic control management (aimed at decreasing congestions), navigation and mobility (information touchscreen kiosks) [4].

Chicago (Illinois). Located at Lake Michigan and having a population number of around 2.7 million (exceeding 9.5 million in Chicago metropolitan area), Chicago is ranked the 3rd in the U.S. by population number, being the most populous city of Midwest. Besides, Chicago is considered to be among the leading smart cities in U.S. "The Array of Things (AoT)" is probably the most well-known example of implementation of innovative technologies in Chicago.

AoT is an urban measurement project comprising an interconnected network of sensor devices ("nodes") that are installed around Chicago to collect real-time data on the city's environment (including climate, air quality, and noise), infrastructure, and activity: thus, to improve the life quality, living experience and conditions in the city. These measurements are published as open data for research and public use [6].

Besides, electricity and water use, city traffic and even criminal cases and situations are being detected and monitored through sensors effectively.

San Francisco (California). The San Francisco smart city program is basically focusing on reducing commercial energy usage significantly. There are hundreds of buildings in San Francisco certified by LEED (Leadership in Energy and Environmental Design, a green building rating system) already. A target to reach a 100% use of renewable energy sources is set as well [3].

In 2014, San Francisco became a Vision Zero City, committing to reduce the number of traffic-related deaths through relevant education, enforcement, and road infrastructure redesign. Vision Zero uses data-driven strategies that focus on creating safer streets, educating the public, enforcing traffic laws, and advancing transformative policies that save lives [7].

Austin (Texas). With the population number of a bit less than 1 million (around 2.5 million in metropolitan area), Austin is the capital city of the state of Texas and the 4th largest city of Texas after Houston, San Antonio and Dallas.

The main aim of Austin smart city approach is to create an ecosystem of accessibility, directing "mobility" into opportunities, such as: access to jobs and services (housing, educational, health, etc.) via a mobility marketplace; access to places that bring together intelligent land uses, future employment centers, and complete and connected neighborhoods; access to technologies that deliver the real value in a smart city – safe, clean and efficient travel made possible with tools from intelligent sensors, to automated and connected vehicles, to fully electrified and decarbonized fleets; access to information through coordinated and optimized two-way data management, etc. [8].

Another program in Austin, called "The Smart City Challenge", includes several mobility components, including: smart stations (providing services for connected and autonomous vehicles), fleet electrification (a program to increase the number of electric vehicles), and traffic safety (a program to reduce fatalities on city streets) [3].

Columbus (Ohio). Columbus, the capital city of the state of Ohio, won the U.S. Department of Transportation's Smart City Challenge in 2016, competing against 77 American. Therefore, the city received funding to implement smart mobility projects focused on electrification, connected vehicles, and intelligent transportation systems.

The main priority directions of Smart Columbus initiative are: mobility (more smart, autonomous and electric transportation), sustainability (ensuring a carbon-neutral city, increasing renewable energy and electric vehicles), digitalization (making services available online improving the quality of life for residents, connecting the city's agencies to promote efficiency, collaboration, and results, providing the residents with affordable internet access along with relevant devices and skills) [9].

Conclusion. The concept of "smart city" is bringing together 2 main priorities of the current urbanization processes: innovations and sustainability. Despite of the lack of formal academic definitions, smart cities can be identified as urban locales, where innovative technologies (particularly, ICT) are practiced successfully to ensure effective urban operations, governance, and services, aimed at increasing the life quality of inhabitants in short-term and long-term perpectives.

The aforementioned case studies clearly reveal and illustrate the great diversity of innovative and smart approaches taken by different cities in the U.S. These approaches can be grouped into the following main directions: increasing the quality and accessibility of public services, monitoring of water and electricity use and the environment, digitalization, better connectivity, smart transportation services and traffic regulation, decreasing urban environmental impact and footprint.

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Տ. Ա. ՍԱՐԳՍՅԱՆ

ՆՈՐԱՐԱՐԱԿԱՆ ՔԱՂԱՔԱՅԻՆ ՁԱՐԳԱՑՈՒՄ. «ԽԵԼԱՑԻ ՔԱՂԱՔՆԵՐԻ» ՀԱՅԵՑԱԿԱՐԳԸ ԵՎ ԴՐԱ ԿԻՐԱՌՈՒՄՆՆ ԱՄՆ-ՈՒՄ

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21-րդ դարում տեղեկատվական և հաղորդակցական տեխնոլոգիաների արագ զարգացմանը զուգընթաց, քաղաքային զարգացման նորարարական մոտեցումների ներդրումը դարձել է ժամանակակից ուրբանիզացիոն գործ-ընթացների կարևորագույն միտումներից ու ուղղություններից մեկը: Խելացի քաղաքները համարվում են նորարարական քաղաքային զարգացման գործընթացի հիմնական պրակտիկ վերջնարդյունքը: Միևնույն ժամանակ, «խելացի քաղաքներ» և «կայունություն» հասկացությունները փոխկա-պակցված են և փոխպայմանավորված: Այսպիսով, առաջացել է «խելացի կայուն քաղաքներ» հասկացությունը, որը բնութագրում է «խելացի» և նորարարական քաղաքային տեխնոլոգիաների օգտագործումը երկարաժամ-կետ և հավասարակշռված քաղաքային զարգացմանը հասնելու համար՝ սոցիալ-տնտեսական, ինստիտուցիոնալ, մշակութային և բնապահպանական ասպեկտներով:

Նորարարական քաղաքային զարգացումը առանձնահատուկ նշանակու-թյուն ունի ԱՄՆ-ի համար՝ հաշվի առնելով երկրի քաղաքային բնակչության մեծ տեսակարար կշիռը (ավելի քան 80%), ընդարձակ և խիտ բնակեցված խոշոր ուրբանիզացված գոտիների առկայությունը, ինչպես նաև ուրբանիզացիայի գործընի առանձնահատուկ դերն ու կարևորությունն ամերիկյան կենսա-կերպը, տնտեսության և սոցիալական հարաբերությունների համատեքստում:

Տվյալ հոդվածի տեսական բաժինը նվիրված է նորարարական քաղա-քային զարգացման և խելացի կայուն քաղաքների՝ վերը նշված տեսական զարգափարների և առանձնահատկությունների ուսումնասիրությանը: Գործ-նական բաժնում ուսումնասիրվել, համեմատվել և ամփոփվել են ամերիկյան 5 խելացի քաղաքների (Նյու Յորք, Սան Ֆրանցիսկո, Կոլումբուս, Օսթին և Չիկագո) օրինակները:

Т. А. САРГСЯН

ИННОВАЦИОННОЕ ГОРОДСКОЕ РАЗВИТИЕ:
КОНЦЕПЦИЯ "УМНЫЙ ГОРОД" И ЕЕ ПРИМЕНЕНИЕ В США

Р е з ю м е

Наряду с быстрым развитием информационных и коммуникационных технологий в XXI веке, внедрение инновационных подходов городского развития стало важнейшей тенденцией и направлением современного процесса урбанизации. "Умные" города считаются основным практическим результатом инновационного городского развития. Между тем, концепции "умный город" и устойчивости взаимосвязаны и детерминированы – таким образом возникла концепция "умный устойчивый город", характеризующая использование "умных" и инновационных городских технологий для достижения долгосрочного и сбалансированного городского развития в социально-экономическом, институциональном, культурном и экологическом аспектах.

Инновационное городское развитие приобретает для США особое значение, т.к. учитывает большую долю городского населения страны (свыше 80%), распределение крупных и густонаселенных урбанизированных территорий по территории страны, а также уникальность фактора урбанизации в американском образе жизни, экономике и социальных отношениях.

Теоретический раздел данной статьи посвящен изучению вышеупомянутых теоретических идей и особенностей инновационного городского развития "умных" устойчивых городов. В практическом разделе были изучены, сравнены и обобщены соответствующие примеры пяти американских "умных" городов: Нью-Йорка, Сан-Франциско, Колумбуса, Остина и Чикаго.