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PROBLEM OF SMART CITY INDIVIDUAL COMPONENTS FORMING

Abstract. *The development of the digital society has led to the relevance of new research in the direction of considering Smart City as a paradigm of social development. The article defines the interpretation of "municipality competitiveness". There is also a review and analysis of recent research in the direction of building Smart City as a component of post-industrial economies of many countries. It is determined that the transformation of large industrial cities into Smart City is a global trend as well as a realistic prospect for many Ukrainian cities and the main driving force of development is the active participation of citizens in city life and management using intelligent and information systems based on information and communication technologies. In the direction of features and priorities of Smart City separate components formation the need for algorithms which have properties to adapt to changing scenarios of city services work and help the corresponding services to make the considered and at the same time operative decision in any even emergency situation is considered. Areas of Smart City development in the context of development of new information and communication technologies are defined. The basis and result of the existence of Smart City infrastructure is a single information space for processing urban processes and procedures – from environmental to social ones. This article explores the current trends and directions of Smart City creation, the organization of development of Smart City components in advanced countries and Ukraine. It is suggested that other key components, such as transport, security and trade, can be considered in the process of becoming a Smart City. Smart City infrastructure helps the socio-economic sphere, enterprises and households to increase economic efficiency reduce the burden on the environment, ensure the comfort and safety of residents. The result of these serious objectively necessary transformations will be an attractive Smart City, integrated into the interregional and international intelligent network, able to make the most effective use of the territorial and resource potential available to it.*

Keywords: Smart City; security; enterprise; ICT; trade enterprise; intellectual infrastructure; information system; information database; knowledge base

Introduction

Current trends in the development of the world's leading countries and the restructuring of existing post-industrial economic systems are caused by the exhaustion of extensive factors of development and the objective need to change technology and digitalization of economies.

As a result, the priorities of social development are also changing.

At the same time, the fundamental foundations for the development of many national economies are changing. The paradigm of "enterprise as the main link of the economy" is replaced by the paradigm of "municipality as the basis of social development" [1].

"Growth points" of modern economies in many countries (USA, China, South Korea, Singapore and others are cities. Changing the paradigm of economic development leads to a change in priorities [1, 2].

Socially oriented indicators replace the classic economic indicators of enterprises and states efficiency. These indicators record the transition from technocratic aspects to humanistic and general civilization ones [1].

The above mentioned trends led to the relevance of new research in considering the features and priorities of Smart City individual components.

The purpose of the article

Review and analysis of recent research in building Smart City as a component of post-industrial economies of many countries.

Main material

The concept of a "smart city" which began its formation in the late twentieth century is being actively discussed in Ukraine. A rare forum on urban issues and information and communication technologies is without discussions related to the implementation of the "smart city" project.

"Smart City" (or Smart City) does not have a clear definition; it is a very multifaceted phenomenon.

There are many definitions for Smart city, including the following:

Smart City is ensuring modern quality of life through the use of innovative technologies that provide economic and environmental use of urban life systems [1];

Smart City is an interconnected system of communication and information technologies with the Internet of Things (IoT), which simplifies the

management of internal processes of the city and improves living standards [2];

Smart City is a structure that provides sustainable development, improving the quality of life and efficient use of resources for its residents [3];

Smart City is a city that combines engineering infrastructure, IT infrastructure, social infrastructure and business infrastructure to use the collective intelligence of the city [4, 5].

From these definitions we can conclude that Smart City is a set of measures aimed at improving the quality of life by digitizing various areas of city life.

For this reason the new interpretation of the "competitiveness of the municipality" which can no longer be reduced to the gross cost indicators that characterize the process approach rather than its results appears.

In this aspect, the modification should address the wider use of the concept of "competition of territories for resources". Recently, the understanding that in theory competition in its purest form leads to monopoly, but in practice is the concentration of population in the few largest cities with the degradation and stagnation of smaller cities and their agglomerations and, consequently, the exclusion from the economic turnover of huge territories, "went into shadows".

Today the key task is to create conditions for the development of cities of all types which provide the uniformity of economic and social development of the country by increasing their competitiveness. And the decisive role here is played not by competition but by relations of rivalry, interaction and mutual assistance based on the most efficient use of limited resources, primarily intellectual.

The task of creating conditions for the development of modern cities as intellectual centers that provide in practice the priority of information and intangible parameters of urban development (urban software) over traditional material elements (urban hardware) [1], turning them into "smart cities" is actualized.

The inclusion of the term Smart City in business implies the need to specify it in relation to the practice of municipal government. "Urban productivity" as an aggregate indicator of the efficiency of the municipality now depends not only on the city endowed with a certain real network infrastructure (physical capital), but also on the availability and quality of knowledge and social infrastructure for their "carriers" (intellectual capital).

It is the intellectual form of capital that is crucial for urban competitiveness. Against this background, the introduction of the concept of "smart city" becomes a key element of strategic management, able to combine in the general framework of traditional factors of urban production and developing information and communication technologies (ICT) to form social and environmental capital of modern city [6 – 9].

The presence of the latter allows distinguishing Smart City from other urban formations, to draw a clear line between them and to understand what exactly is hidden under the term digital or smart city.

According to some scholars [8 – 12], a city can be defined as "smart" provided that investments are directed to human and social capital and such traditional areas for most cities as transport and information and communication technologies (ICT). This is the key to sustainable economic development and a high quality of life associated with the rational and most effective management of natural resources based on the assistance of all participants in city life.

As noted in [1; 2], the concept of Smart City essentially means efficiency achieved through intelligent management and integrated ICT, as well as active participation of citizens in the development of the city [2].

Smart City can be defined as systems that integrate the following areas (axes) of activity within a single urban space, in the context of smart / reasonable [3]:

1) economy;
2) mobility;
3) environment;
4) people;
5) life;
6) management.

These six axes must be linked to traditional regional and neoclassical theories of urban growth and development. In particular, the axes are based on theories of regional competitiveness, efficient use of natural resources, transport mobility and ICT of the urban economy, priority formation of human and social capital, improving the quality of life, and citizen participation in urban governance.

Smart City is defined by their innovation and ability to solve problems and use ICT to increase their potential. Intelligence is the ability to solve society's problems by developing and / or transferring technology. In this sense, intelligence is the internal quality of any territory, city or region where innovation processes are facilitated by ICT.

However, it should be emphasized that intelligence as a special resource and a growth potential is strongly dependent on the level of intelligence of an individual, the system of cooperation of individual intelligences (synergy or conflict), the level of digital infrastructure tools that the community offers its residents, and the degree of their use.

It is worth noting that to date the designation "smart city" is still a rather vague concept and is not always used according to agreed criteria. In this regard, it is necessary to consider in more detail the characteristics of Smart City which are most often mentioned when discussing this topic.

In modern conditions, there is a need to use network infrastructure in order to improve economic and political efficiency and ensure social, cultural and urban

development [4]. The term "infrastructure" in this context refers to the development of business services, housing, recreation, business, trade, lifestyle and ICT (mobile phones, satellite TV, computer networks, e-commerce, Internet services, etc.), and also highlights the idea of "Network City" as the main model of development and source of growth [5].

This emphasizes the crucial role of high-tech and creative areas in the long run of urban growth.

These aspects, along with the "soft" infrastructure, are the core of research [6]. The main idea of the work is that companies are now focused on attracting "creative people" who are able to solve problems more effectively and from a different angle.

Although the presence of creative and skilled labor does not guarantee the effective functioning of the urban economy, but it is obvious that in a knowledge-intensive economy these factors will be most conducive to the success of urban development [6; 7].

It is necessary to make maximum use of ICT opportunities, which provide an increase in local welfare and competitiveness and imply a comprehensive, multi-sectoral approach to urban development based on a system of hierarchical indicators and the perspective of multilevel planning [8; 9].

This aims to ensure the formation of business at the forefront of urban development with a view of attracting new investment and businesses. The data show that business-oriented cities do prevail among cities with satisfactory socio-economic indicators.

One of the brightest examples of such a "smart city" is Dubai which is not only developing as a Smart City, but also replicates its model of urban development in the international space in the form of urban projects.

It should be noted that local intellectual potential is inextricably linked to the security of the knowledge-based economy, where innovation and technology are the main drivers of growth and development of the collective intellectual community [8], which, in turn, considers the potential of connections as a major factor for the success of the local community [9].

The formation of Smart City involves clear planning that directly affects the development of the urban environment (infrastructure), territorial (spatial) development and development of innovation management based on the concept of creating a multi cluster of territories. By developing intro urban planning in this direction cities can reach the interregional and international level for faster integration of innovations.

CTs have proven to be one of the most effective means of solving urban problems. To do this the various components of urban development must be combined into a single system.

Today, we can identify the five most important trends related to ICT and able to change the look of modern cities and agglomerations [10-15]:

1) remote access to all types of services and services;

2) intelligent or Smart urban infrastructure;

3) implementation of ICT solutions to ensure public and information (cyber) security;

4) IoT;

5) development of wireless IT.

A resident of Smart City can save time without queuing, but by receiving all municipal services remotely, the necessary information about the work of public transport, various institutions, distance education. In short, a resident of Smart City manages his own life, building a schedule, a schedule of attendance at school, work, institutions, places of rest, which is convenient for him. And all communication technologies exist to help him in this.

Much research in the field of Smart City development is devoted to the development of new ICT, separate, wireless networks.

Wireless sensor networks are specific technologies that allow you to create truly "smart cities". The goal is to create a distributed network of intelligent sensor nodes that can measure many parameters for more efficient city management [7]. Data is transmitted over a wireless network in real time to citizens or to relevant authorities or authorities.

For example, citizens can monitor the concentration of pollution on every street in the city or can receive automatic alarms when the radiation level rises to a certain level. In addition, you can optimize the watering of parks or city lighting. Ballot boxes can send an alarm when they are close to full.

In addition, it is an effective way to control car traffic, to unload some transport nodes using others [9], to regulate the speed and density of traffic, reduce its volume using systems that detect where the nearest free parking slot [8].

Thus, motorists receive timely and accurate information on where they can find free parking, which saves them time and fuel. Such information can reduce congestion and pollution and improve the quality of life.

Existing common platforms for online data management from sensors make it possible not only to download data from sensors and build dynamics, forecasts and analytical work on their basis, but also to provide greater transparency of calculations in the field of housing.

For example, there are platforms [10] that facilitate interaction between consumers (users) and service providers, allowing developers to build real-time charts and plans directly on websites, analyze incoming information and send the results to the appropriate authorities for operational monitoring and making management decisions.

A city that wants to become “smart” should move in all these directions, but should not reject alternative

points of development, considering them taking into account long-term prospects and consequences of implementation. Thus, if a city chooses a business-oriented model, it must take into account the potential possibility of this business leaving the field of urban development as it grows.

Smart City Infrastructure helps utilities, businesses and households to improve economic efficiency; reduce the burden on the environment; provide comfort and safety of residents, as well as Smart City.

This is accomplished by establishing a system of links between individual systems Smart City.

In particular, these systems include:

– transportation;
– engineering;
– security; management;
– trade, etc.

The only network of sensors and sensors that operate directly in Smart City regulate the operation of major systems, such as:

– city life support systems;
– urban transport flow management systems;
– systems for monitoring the condition of structural elements of urban buildings and engineering structures – bridges, energy and water supply systems,
– systems for meeting socio-economic needs (trade, entertainment, hospitals, schools, etc.)
– systems that provide control points with telemetry, visual and statistically processed information.

Basis and infrastructure outcome existence Smart City is a single information space treatment urban processes and procedures – from environmental to social ones.

From our point of view other key areas, such as transport, security and trade, must be taken into account in the process of becoming a Smart City.

Smart City transport is based on intelligent transport systems.

This means the integration of operational management of all modes of transport and the possibility of reaction to events in real time.

It is important that the transport system is part of the whole system of Smart City and therefore should have the user-friendly interface, in which you can find and use a variety of services – from tips on which parking steer the car to the notification of the date of arrival of public transport.

Major transport innovation Smart City is the creation of cities focused on pedestrians and the desire to minimize the use of private vehicles in the city.

Priority is given to public transport.

Critical to the successful operation of the system is a transport interchange nodes, intercepting parking. In order to ensure their functioning, it is necessary to integrate information and navigation systems within a single Smart City platform.

For Smart City the key is an extensive enlarge in traffic arteries, and increasing the efficiency of the existing road network.

The new occurrence matrix provides mobility within cities multifunctional, hybrid clusters, because, according to experts, a person cannot live in one town, and work in another.

Trade and development of commercial enterprises is a key indicator of the success of the organization Smart City.

After all, if the Smart City boarders comfort and safety come first, the socio-economic structure should be organized on algorithms that not only meet the needs, but must provide dynamic scenarios change vectors of the city and the political and economic external influences.

These algorithms are part of the overall algorithm of the Smart City organization. Since we determine that each algorithm that underlies Smart City is aimed at improving the quality of life, so the digitalization of trade should be aimed at developing the life of the city as a whole. On the other hand, given that any enterprise is profit-oriented, and trade enterprises are the most dynamic in this process, trade is a litmus test for determining the success of not only the organization of socio-economic structure of the city, but also Smart City as a whole.

Security is a key word on everyone's priority list, whether it's personal safety, the safety of their home or business. Current trends in the field of security are not aimed at overcoming the negative consequences, but their forecasting and prediction ensuring minimization of risks and prevention or significant reduction of losses.

The concept of secure Smart City encompasses not only equip households and critical infrastructure facilities of city surveillance cameras, sensors for remote control and management, but also organization and safety of transport, the most convenient and safe organization of urban space (roads, parking lots, courtyards, gardens and so on), information security.

"Safe City" along with the technological aspects of security assigns a significant role of the community as a social component in the fight against crime, drug addiction, in ensuring anti-terrorist security in the territory.

Such an integrated approach, which includes the combination of technical and humanitarian components, becomes the main vector for solving the whole set of tasks to ensure urban security.

Safe technologies of critical urban infrastructure, secure telecommunications and security of every Smart City resident, including his personal data, education and promotion of a healthy and moral lifestyle create the foundation on which to build such a complex economic, social technical environment project as a safe Smart City.

Conclusion

Thus, we can draw a clear conclusion: the transformation of large industrial cities into Smart City is a global trend, as well as a realistically viable prospect for many Ukrainian cities. At the same time, the reorientation in the strategy of development of cities, mega cities and their agglomerations involves a radical restructuring of the management system of municipalities, which includes changing priorities, standards, criteria, goals and objectives, performance indicators and efficiency. Another assessment of the resource potential of the territory is needed, as well as new ways to achieve the set goals.

The main driving force of development is the active participation of citizens in the life of the city and its management using intelligent and information systems based on ICT. The leading success factors in the development of municipalities include:

– knowledge of where the city is moving (residents must understand its purpose, potential and prospects for development, share goals and ways to achieve them);

– the presence of community leaders (at least 1% of the population)

– transparency of decision-making, monitoring of their implementation and evaluation of results;

– strategic planning;

– definition of a single algorithm that organizes, plans and anticipates the needs of Smart City residents (using modern research and development based on neural networks)

– "favorable transformation of politicians' thinking" [4], which is the awareness of the need for superiority of local powers of municipalities over federal bodies, the importance of building municipal government on the basis of public participation.

The result of these serious objectively necessary changes will be attractive for life Smart City, integrated in interregional and international intelligent network capable of leverage available to him territorial and resource potential.

References

1 Glazer, A.L. (2013). City triumph: how our greatest cucess make us reacher, smarter, elilogical, healthy and happy. Economical sociology, 14, 4.

2 Asín, A. (2017). Smart Cities from Libelium Allows Systems Integrators to Monitor Noise, Pollution, Structural Health and Waste Management [Electronic source]. URL: http://www.libelium.com/smart_cities/.

3 Asín, A., Gascón, D. (2018). Smart Sensor Parking Platform Enables City Motorists Save Time and Fuel [Electronic source]. URL: http://www.libelium.com/smart_parking/.

4 Baron, S., Field, J., Schuller, T. (2000). Social Capital: Critical Perspectives. Oxford: Oxford University Press.

5 Caragliu, A., Del Bo, C., Nijkamp, P. (2009). Smart Cities in Europe. Series Research Memoranda 0048. VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics.

6 Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., Meijers, E. (2008). Smart Cities – Ranking of European Medium-Sized Cities [Electronic source]. URL: http://www.smart-cities.eu/download/smart_cities_final_report.pdf

7 Hollands, R.G. (2008). Will the Real Smart City Please Stand Up? City, 12, 3. 303-320.

8 Komninos, N. (2002). Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces. N.Y: Routledge, 320.

9 Nijkamp, P. (2008). E pluribus unum. Research Memorandum, Faculty of Economics, VU University Amsterdam.

10 Odendaal, N. (2003). Information and communication technology and local governance: Understanding the difference between cities in developed and emerging economies. Computers, Environment and Urban Systems, 27, 585–607.

11 Paskaleva, K. (2009). Enabling the Smart City: The Progress of E-City Governance in Europe. International Journal of Innovation and Regional Development, 1, 4, 405-422.

12 Torres, L., Pina, V., Royo, S. (2005). E-Government and the Transformation of Public Administrations in EU Countries: beyond NPM or just a Second Wave of Reforms? Online Information Review, 29, 5, 531-553.

13 Vehicle Traffic Monitoring Platform with Bluetooth over ZigBee [Electronic source]. URL: http://www.libelium.com/vehicle_traffic_monitoring_bluetooth_sensors_over_zigbee/.

14 Yusuf, Z. (2018). Parking Tech: An Accelerator to the Connected City... the Human City [Electronic source]. URL: http://www.huffingtonpost.com/zia-yusuf/parking-tech-an-accelerator_b_3326129.html.

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ПРОБЛЕМАТИКА СТАНОВЛЕННЯ ОКРЕМИХ СКЛАДОВИХ SMART CITY

Анотація. *Розвиток цифрових технологій обумовив актуальність нових досліджень у напрямі розгляду Smart City як парадигми суспільного розвитку. В статті визначено трактування «конкурентоспроможності муніципалітету». Також проведено огляд та аналіз останніх досліджень у напрямі розбудови Smart City як складових постіндустріальних економік*

багатьох світових держав. Визначено, що перетворення великих індустріальних міст в Smart City є загальносвітовим трендом, а також реально досяжною перспективою для багатьох українських міст, а головною рушійною силою розвитку стає активна участь громадян у житті міста і управлінні ним з використанням інтелектуальних і інформаційних систем на базі інформаційно-комунікативних технологій. У напрямі особливостей та пріоритетів становлення окремих складових Smart City розглядається потреба в алгоритмах, які мають властивості адаптуватися до зміни сценаріїв роботи міських служб та допомагати відповідним службам приймати зважені та водночас оперативні рішення в будь-якій, навіть нештатній ситуації. Визначено області розбудови Smart City щодо розвитку нових інформаційно-комунікативних технологій. Основа і результат існування інфраструктури Smart City – єдиний інформаційний простір оброблення міських процесів і процедур – від природоохоронних до соціальних. У статті досліджено сучасні тенденції та напрями створення Smart City, організації розвитку складових Smart City як передових держав, так і України. Запропоновано, в процесі становлення Smart City, враховувати також інші ключові складові, такі як транспорт, безпека та торгівля. Інфраструктура Smart City допомагає соціально-економічній сфері, підприємствам і домогосподарствам підвищувати економічну ефективність; зменшувати навантаження на навколишнє середовище; забезпечувати комфорт та безпеку мешканців. Результатом цих серйозних, об'єктивно необхідних перетворень стане привабливий для життя Smart City, інтегрований в міжрегіональну і міжнародну інтелектуальну мережу, здатний максимально ефективно використовувати доступній йому територіальний і ресурсний потенціали.

Ключові слова: Smart City; безпека; підприємство; ІКТ; підприємство торгівлі; інтелектуальна інфраструктура; інформаційна система; інформаційна база даних; база знань

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ПРОБЛЕМАТИКА СТАНОВЛЕНИЯ ОТДЕЛЬНЫХ СОСТАВЛЯЮЩИХ SMART CITY

Аннотация. *Развитие цифровых технологий обусловило актуальность новых исследований в направлении рассмотрения Smart City как парадигмы общественного развития. В статье предложена трактовка «конкурентоспособности муниципалитета», проведен обзор и анализ последних исследований в направлении развития Smart City как составляющих постиндустриальных экономик многих мировых держав. Установлено, что преобразование больших индустриальных городов в Smart City является общемировым трендом, а также реально достижимой перспективой для многих украинских городов, а главной движущей силой развития в этом случае становится активное участие граждан в жизни города и управлении им с использованием интеллектуальных и информационных систем на базе информационно-коммуникативных технологий. С целью исследования особенностей и приоритетов становления отдельных составляющих Smart City рассмотрена потребность в алгоритмах, которые имеют свойства адаптироваться к изменению сценариев работы городских служб и помогать соответствующим службам принимать взвешенные, и в то же время оперативные решения в любой, даже нештатной ситуации. Определены области развития Smart City в разрезе развития новых информационно-коммуникационных технологий. Основа и результат существования инфраструктуры Smart City – это единое информационное пространство обработки городских процессов и процедур (от природоохранных к социальным). Исследованы современные тенденции и направления создания Smart City, организации развития составляющих Smart City как передовых государств, так и Украины. Предложено в процессе становления Smart City учитывать также другие ключевые составляющие, такие как транспорт, безопасность и торговля. Инфраструктура Smart City помогает социально-экономической сфере, предприятиям и домохозяйствам повышать экономическую эффективность, уменьшать нагрузку на окружающую среду, обеспечивать комфорт и безопасность жителей. Результатом этих серьезных, объективно необходимых преобразований станет привлекательный для жизни Smart City, интегрированный в межрегиональную и международную интеллектуальную сеть, способный максимально эффективно использовать доступные ему территориальный и ресурсный потенциалы.*

Ключевые слова: Smart City; безопасность; предприятие; ИКТ предприятие торговли; интеллектуальная инфраструктура; информационная система; информационная база данных; база знаний

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