Problems of Development Comfortable Human Life Environment based on Sustainable City Concept

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Abstract: The development of the human environment in the digital economy is associated with the spread of digital technologies within the framework of the concept of a smart city. Nevertheless, the concept of sustainability of the living environment in the long term, taking into account environmental and socio-economic factors, is becoming increasingly important, which is reflected in the concept of a smart sustainable city. The concept of a smart sustainable city, in large part due to its complexity and long horizon of modeling, is a key area of improving the human environment at the present stage of development of technology, society and economy. The article describes the concept of a smart sustainable city, considers practical examples of the implementation of this concept. As a result of the work, the problems inherent in the development of the living environment based on the concept of a smart sustainable city were identified, and the relevance of the application of an interdisciplinary approach to their solution was substantiated.

1 INTRODUCTION

In the context of accelerating urbanization and the emergence of a digital economy (Ablyazov & Asaul, 2018; United Nations, 2015), improving the human environment is becoming a key area of socio-economic development for individual cities, regions and countries. One of the most common theoretical approaches to the development of the living environment is the concept of a smart and sustainable city. It is known that the concept of a smart city was first mentioned in the 1960s, which was associated with the appearance of cybernetically planned cities (Gabrys, 2014). According to other scientists, the concept of a smart city began to be applied only in the 1990s. (Dameri & Cocchia, 2013; Neirotti et al, 2014). Moreover, there is an opinion that the implementation of the concept of a smart city has been observed only in the last 10-15 years (Batty et al, 2012).

In general, a smart city shall be considered as a set of digital (smart) elements of the human environment, including transport, energy, education, health care, public administration, economy, housing and communal services, construction, etc. (Vishnivetskaya & Ablyazov, 2019; Vishnivetskaya & Elexandrova, 2019). Nevertheless, more and more attention of the scientific community is being paid to the questions of the living environment sustainability, not just the introduction of digital technologies for the development of one of the above elements of urban infrastructure.

The concept of sustainability is at the intersection of three components of the human habitat - environment, economy and society (Bibri, 2021). The concept of a sustainable city covers a wider range of tasks for the development of the living environment than smart city, including improving the quality of the environment from an ecological point of view and also the socio-economic development of territories (creating a competitive economy, reducing unemployment, increasing the affordability of housing, education and health care, community involvement in solving city and country development issues) (PwC, 2015).

The concept of a sustainable city is aimed to create such a living environment, where attention shall be paid to the natural resources usage,

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biodiversity, prevention of pollution of territories, the growth of the well-being of citizens, the intensification of scientific research, equality before the law, involvement in the issues of city management, etc.

Thus, while the concept of a smart city is focused on the spread of digital technologies in certain areas of the living environment (transport, public administration, education, etc.), a sustainable city is inextricably connected with the integrated development of the human environment, and it doesn't have to be based on the technological improvement of infrastructure, as the emphasis is on results rather than the tools to achieve them.

Currently, such an approach to the development of the human life environment as a smart sustainable city is gaining popularity, which combines the issues of improving the technological equipment of the territory's infrastructure and focusing on environmental and socio-economic aspects in the long term (50-100 years) (Al-Nasrawi et al, 2015; Höjer & Wangel, 2015; Kramers et al, 2016). A smart sustainable city is an innovative city where digital technologies shall be used to improve the quality of life of the population and the efficiency of services in the city, providing the needs of future generations of residents in terms of environmental and socio-economic components.

The implementation of this concept is an interdisciplinary task, because the wide range of issues that need to be taken into account when building a smart sustainable city include the theory and practice of such areas of knowledge as informatics, urban planning, sociology, political science, economics, public administration, psychology, engineering, education, medicine, etc. Due to the complexity and multidimensionality of the concept of a smart sustainable city, the work analyzes the practical experience of implementing smart sustainable city technologies and highlights the problems inherent in this process. The purpose of the work is to propose ways to solve the identified problems in order to intensify the sustainable development of the human environment.

2 MATERIALS AND METHODS

The formation of a sustainable human living environment is currently inextricably linked with the digital tools usage in order to analyze the development of the territory and manage the digital transformation of the city. Let's look at some examples of smart sustainable city technologies.

The Urbanseed platform allows you to analyze the state of the human environment in such areas as housing construction, infrastructure facilities and economic activities of territorial entities in order to manage urban development (Urbanseed, 2021). Urbanseed is intended for city authorities, developers, cadastral services. The platform has combined three aspects of the sustainability of the living environment - ecology (landscaping the territory, preserving biodiversity), economy (income and expenses from the implementation of an investment and construction project) and society (type of development, integration into the living environment).

A digital platform created by EDF is operating in Singapore, which allows, in the shortest possible time (5-10 minutes), to create a 3D model of a city district in the field of assessing energy efficiency, population mobility, and the level of greenery (Vivapolis, 2019). With the help of technology, the state of the living environment shall be predicted after the introduction of one or another innovation, the modeling period reaches 20 years, which makes possible to assess the financial, environmental and social aspects of the solution.

Also, according to the results of the 4th WeGO Awards, which evaluates the results of the formation of smart sustainable cities around the world, digital technologies of such cities as Moscow, Istanbul, Sao Paulo, Mexico City, Jakarta, Georgetown, Seongnam, Mashsad, etc. (Winners of the 4th WeGO Awards, 2020). Accordingly, capitals and million-plus cities do not always become leaders in the development of the living environment. Thus, the Digital Saint-Etienne platform (France) is aimed at developing the human environment in 3 districts with 7 thousand inhabitants (Vivapolis, 2019). The platform allows to rank projects by priority, increase the manageability of infrastructure, and improve interaction with the population.

Thus, there are examples around the world of digital tools (usually digital platforms) used to improve the living environment in accordance with the concept of a smart sustainable city. Digital technologies shall be used in various aspects of city functioning , therefore, for their integration within a single platform, it is necessary to form interdisciplinary teams. It is also worth noting that all the tools for implementing the concept of a smart sustainable city (in different directions, by type - sensors, systems, platforms, open portals, etc.) should be interconnected, since otherwise it is difficult to achieve the development goals of the territory.

3 RESULTS

The concept of smart sustainable cities has spread over the past 10-15 years, and the development of a living environment, taking into account both technological aspects and sustainability over a long period of time, is accompanied by a number of problems.

The main barrier to the effective development of the human life environment is the lack of a holistic vision of the transformation results. Very often cities develop infrastructure only in terms of new technologies, but a smart sustainable city must simultaneously develop in social, economic, environmental and technological directions (Abdoullaev, 2011).

Moreover, the concept of a smart sustainable city can be implemented in cities with different population sizes - from small cities to world megapolises, however, the development of smart cities shall be still associated to a greater extent with world capitals and large industrial centers.

In general, there is no city always developing completely in accordance with the concept of a smart sustainable city, since at one time or another the improvement of the living environment is aimed at one or several aspects, including management, new technologies, mobility, openness and inclusiveness, safety, sustainability (Winners of the 4th WeGO Awards, 2020).

As noted earlier, the human environment can be developed both in accordance with the concept of a smart city and with the concept of a sustainable city, separating them. However there is a need to combine the two concepts in practice, and this approach leads to the following problems (Bibri, 2019)

1. Smart city technologies are aimed at increasing the efficiency of the processes of functioning of the living environment, and the concept of a sustainable city is more focused on solving problems in the long term (ecology, living standards, development of economic ties, etc.).

2. Not all digital technologies in a smart city are aimed at improving the resilience of the living environment. This problem is especially manifested in matters of environmental preservation.

3. Assesment of the results of the concept of a smart city implementation shall be carried out in a shorter period of time in comparison with the planning horizon for a sustainable city.

4. Within the framework of a smart city, investors try to introduce as many new technologies as possible, but not all of them shall be required if we consider the living environment and from the point of view of sustainability.

5. Problems of sustainability of the living environment already require immediate solutions, while smart city technologies are often aimed at solving potential problems that leads to the accumulation of unresolved problems in the field of sustainability of the living environment, which will be even more difficult to solve in the future.

6. A smart city is largely aimed at the economic and technological development of the territory, with less, than in a sustainable city, taking into account the social and environmental results of certain innovations.

7. A smart city shall be assessed in terms of the economic efficiency of the introduction of new technologies, while sustainable technologies spreading shall not be always associated with profit, since there are indirect environmental and social effects.

In addition, the problematic aspects in the field of the formation of a smart sustainable city, presented in Fig. 1, are interrelated, and their solution requires taking into account the experience and knowledge of specialists in different fields of activity. Each of these blocks has obstacles on the path of transformation, and in the aggregate, these problems must be solved systematically.

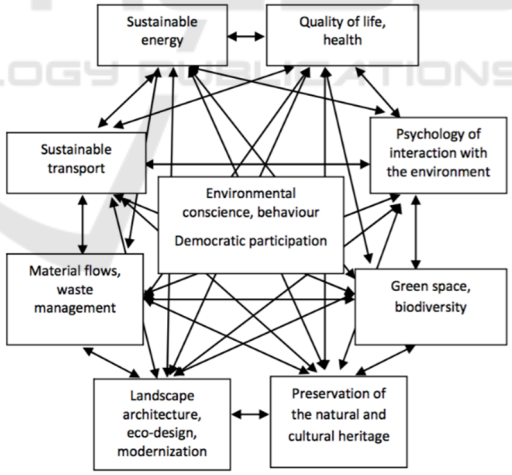

Figure 1: The problematic aspects in the field of the formation of a smart sustainable city (Shmelev & Shmeleva, 2009).

Currently, the development of the human environment is associated with the use of an interdisciplinary approach, since the implementation of the concept of a smart sustainable city requires the development of solutions that are at the intersection of areas of scientific knowledge (Ablyazov, 2020).

Moreover, in order to successfully overcome the problems in the implementation of the concept of a smart sustainable city, it is necessary to involve the population and business entities in the process of finding optimal solutions (PwC, 2015). The inhabitants of the territory can both focus the attention of professionals on previously unaccounted for problems, and offer solutions based on their own experience. Entrepreneurial structures can, on the one hand, gain practical experience in introducing their own technologies, and on the other hand, receive information about the existing problems in the city in order to subsequently develop new solutions that the population needs.

Also, the most important element of a smart sustainable city is the availability of open big data, related to the state of the environment and transport, consumer behavior, population involvement in management processes, etc. Open big data is fragmented, and only interdisciplinary approach will allow to analyze and make a comprehensive forecast, taking into account the many interconnections between problem areas of the city.

Thus, the implementation of the concept of a smart sustainable city currently faces a number of problems associated with the lack of simultaneous consideration of aspects of both smart and sustainable cities. In our opinion, overcoming these obstacles is largely associated with the use of an interdisciplinary approach, especially in the context of the increasing importance of open data accumulated in the process of life of the territory.

4 DISCUSSION

The development of the human environment based on the concept of a smart sustainable city is largely associated with the analytics of the data generated during the functioning of the city. There is an opinion that the main technologies that contribute to the sustainable development of territories are big data and the Internet of Things, which together allow to optimize infrastructure, improve the quality of the environment, increase the level of convenience of providing services to the population, and make the living environment safer and more comfortable (Susanti et al, 2016).

Big data has three characteristics - volume, variety and velocity, although more and more scientists note the fourth characteristic - veracity, which is largely important for building adequate models of the development of the living environment (Gandomi & Haider, 2015; Philip Chen & Zhang, 2014; Rodríguez- Mazahua et al, 2015). Data collection is provided through the Internet of Things, which connects the physical objects of the city and transfers information to data processing centers. As of 2020, there are around 50 billion data collection devices all over the world (Sta, 2017). However, 95% of the received information is not structured, it makes difficult to carry out analysis and forecasting in order to develop optimal solutions for the development of the living environment (Miah et al, 2016).

In order to provide information support for the implementation of the concept of a smart sustainable city, it is necessary to use data analysis platforms, among which are Hadoop MapReduce, Spark, Stratosphere and NoSQL-database system management (Al Nuaimi et al, 2015; Fan & Bifet, 2013; Karun & Chitharanjan, 2013).

Moreover, the processing of results prepared using special software requires an interdisciplinary approach. The obtained results of the analysis cover certain aspects of the city's life, and decisions made without taking into account the state of all aspects will not allow achieving the planned results of the transformation of the territory, that will lead to the fragmentation of the city's development and, possibly, negative consequences in the long-term period of the assessment. The presence of interdisciplinary project teams for the development of the living environment will allow for a comprehensive assessment of data and model the most realistic forecasts, taking into account the relationship between all areas of the city's functioning.

Thus, despite the important role of digital technologies and big data in particular, the knowledge and experience of specialists is still an important factor in the effective development of the human environment. Therefore, along with the spread of new technologies, it is necessary to involve specialists in various fields of knowledge in the development of the living environment in order to take into account the many factors inherent in both the concept of a smart and sustainable city, find contradictions between them and successfully remove of them.

5 CONCLUSIONS

The development of the human environment in the digital economy is inextricably connected with the introduction of new technologies. Carrying out the transformation of the human environment, the subjects of the functioning of the territory shall be guided by the provisions of the concept of a smart city or the concept of a sustainable city. Currently it is necessary to unify the ideas and principles which

contained in these concepts into a smart sustainable city.

Nevertheless, due to the novelty of the concept of a smart sustainable city and also the contradictions presence between the main provisions of the two previously separate concepts, the process of development of the living environment shall be accompanied by a number of problems discussed in this article.

In our opinion, overcoming the obstacles in the implementation of the concept of a smart sustainable city requires an interdisciplinary approach. Modern cities generate large amounts of information in all areas of the functioning of the living environment, and their effective analysis is possible exactly within the framework of interdisciplinary projects.

The development of the human life environment based on the concept of a smart sustainable city will increase the comfort of life of the subjects of the city territory, however, in order to achieve the long-term goals of city transformation, it is necessary to remove the existing conceptual contradictions, based of an interdisciplinary approach.

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