

"Smart city", man and architecture

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Abstract. The article is devoted to the problem of introducing the concept of a "smart city" into the life of modern cities. The authors consider a "smart city" in terms of its architectural and urban planning qualities, as well as meeting the needs of citizens. The issues of the formation of a new architecture corresponding to the challenges of a "smart city" and development of historical cities in the context of information technologies are analyzed. The authors reviewed the dynamics of the implementation of the provisions of the concept of a "smart city" in the cities of Russia.

1 Introduction

Over the past 20 years, digital technologies and urban spaces have created a single network that provides constant communication between metropolis and its residents. The outcome of this integration was the concept of a "smart city" (Smart City), which belongs entirely to the 21st century. This fact, of course, does not mean that historic cities were "not smart" or in fact - stupid. The popular term "smart city" nowadays is a loan translation from the English word "Smart City." Rather, in this case it is necessary to speak not about the brainpower or stupidity, but about the formation of a reasonably managed city where management decisions should be based on objective information. In our modern world the database is created by digital technology. Hence the illusion that widespread use of ICT will ensure that the city operates effectively itself.

The term itself still implies many interpretations and discussions. Other terms used in similar concepts include a digital city, an information city, a cyberville, an omniscient city, a pervasive city, etc. Globally speaking, the term "smart city" refers to the concept of urban space development by integrating information and communication technologies (ICT) and Internet of Things (IoT) to manage the city. It is believed that the goal of a "smart city" creation is to improve the quality of life of its residents with the help of urban computer science technology to improve the efficiency of service and meet the needs of citizens [1]. At the same time, it is necessary to mention other translations of a "smart city" offered by economists, information technology specialists, sociologists, communicators, political scientists, urbanists [2–4].

In addition to these researches, developments on the physical structure and shape of a "smart city" are also needed. Another question to be answered is how different such cities

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should be from the existing ones; is it possible for a historic city to be transformed into a smart city? This article is devoted to answers to these questions.

2 Architecture in information technology networks

Since the beginning of the 21st century, there have been huge changes in the way information technology is developed in architectural activities. Modern architecture is in a condition of great shift of its main paradigms [5]. We are witnessing a dense adhesion of architecture and technology, architecture is becoming more hybridized when reality merges into virtuality [6].

At the same time, one of the possible transformations of a modern city will be a change in its visual image. An example of a fresh look at changing the image of the city is Danish group BIG project, dedicated to the City of Tomorrow (2010). The project was implemented by Audi Corporation to predict the development of urban transport infrastructure. Project manager Bjarke Ingels considers information technology as a tool to create a new urban environment ("Plastic City"), no longer burdened with the usual street components and permanent traffic rules ("Static city"). Ingels proposes to replace traditional elements of the road, sidewalk or square with a programmable surface lined with light elements. Such a digital layer would illuminate the pixels in the place where in a few seconds the self-driving vehicle will pass, so that pedestrians can anticipate and react to the situation. In such a city it will be possible to see the upcoming movements due to this animated graphic surface. The result will be a flexible urban space that can stretch and shrink so as to adjust to peak traffic hours and allow the park or the square to invade the road routes, while matching the demands and desires of the citizens. It is expected that the project can be implemented in 2030.

3 Historic City: Adapting the Smart City Concept

The second view on the development of architecture in the context of the information technology influence is to preserve the architectural image of existing historical cities in the development of their digitalization. Examples include cities such as Amsterdam (Amsterdam Smart City programme), Barcelona (iBarcelona), Madrid (Madrid Inteligente/Smarter Madrid), Milan, Stockholm and others. Analysis of these examples shows that each city interprets the concept of a "smart city" differently. For example, the Green Information Technology/IT strategy is being implemented in Stockholm, Sweden. (GreenIT) [7]. The Green IT program aims to reduce the city's negative impact on the environment through IT properties such as energy efficient buildings (minimizing heating costs), traffic monitoring (minimizing travel time) and the development of electronic services (minimizing the use of paper). The city uses an "electronic Stockholm" platform (e-Stockholm), which is designed to provide electronic services, including political announcements, parking reservations and snow removal [8]. The platform is powered by GPS analytics, allowing residents to plan their route through the city. An example of smart city technology for a particular area is shown by the Swedish scientific town of Kista (Kista Science City). The district was based on the concept of "smart cities" "with triple helix" [9], where university, industry and government work together to develop ICT applications to implement the Smart City strategy.

In Milan (Italy) unlike many European cities, smart city strategies are more focused on social sustainability than on ecological one [10]. In New York, various ways of implementing smart city technologies are being developed. One of these directions was the network of city kiosks servicing the network Link NYC. They provide services such as free

Wi-Fi, phone calls, charging stations, local route searches and more. Advertising information on kiosks' screen was the financial engine of this "smart network".

4 "Smart Cities" in Russia

How is the concept of a "smart city" being implemented in Russia?

In our country, the concept of a "smart city" began to be widely implemented in 2018. The Ministry of Construction of the Russian Federation has prepared a list of 20 Russian cities from which the implementation of the federal program "Smart City" began. Among them are Moscow, St. Petersburg, Voronezh, Eupatoria, Perm, Novosibirsk, Great Novgorod, Kotovsk (Tambov region), Ufa, Elabuga (Tatarstan), Togliatti, Glazov (Udmurtia), Magas (Ingushetia), Yekaterinburg, Satka (Chelabinsk Region), Sarov (Nizhegorodsk region), Novouralsk (Sverdlovsk region), Sosnoviy Bor (Leningrad region), Izhevsk and Sarapul (Udmurtia). The project aims to implement high technology into urban management. This applies to the creation of a comfortable environment, the functioning of utilities, urban planning, safety, traffic and pedestrian flows management.

Two programs have been developed in Moscow: "Electronic Moscow" and "Information City" [11]. The first program provided the city administration with communication infrastructure and fleet of digital equipment for officials and social workers. Within the framework of the "Information City" the capital was engaged in the automation of urban processes, many services were transferred to digital format. Automation has touched medicine - a single medical information analysis system (EMIAS), education — Moscow Electronic School (MES), city management by its residents — "Active Citizen" and other areas of life.

In 2018, Moscow Department of Information Technologies has developed a digital strategy "Smart City 2030" [12]. The strategy is based on six main areas: development of social and human capital, digital mobility, smart economy, comfortable urban environment and digital government.

This year the Ministry of Construction of the Russian Federation has developed the standard of a "Smart City" which included 8 blocks:

- City Management
- Smart housing and utilities
- Innovations for urban environment
- Smart urban transport
- Intelligent public safety systems
- Intelligent environmental safety systems
- Infrastructure of communication networks
- Tourism and service.

From our point of view, the most interesting block is "Innovation for urban environment", which includes arrangements of architectural and artistic illumination of cities.

Considering the problem of introducing the concept of a "smart city" into Russian practice, it should be emphasized that digitalization does not eliminate mistakes in management decisions. On the one hand, in the Russian City Planning Code, the documentation system describes 5 components of urban planning: territorial planning (STP –territory use planning scheme, GP- city master plan), urban zoning (PZZ –land use and development rules), territory planification (PP – planning project and PM –boundary setting plan), city master plans, architectural and construction design, construction. In practice, management system of the territorial planning is supervised by the Ministry of Economic Development of the Russian Federation, and the other components are supervised by the

Russian Ministry of Construction. Both ministries rely on their own information systems with insufficient horizontal links between ministries. This has led to the decision at the highest level to cancel the main document defining the spatial development of megacities, the city master plan. The city master plans should be replaced by a document defining strategic directions of urban development of the city, based on the strategy of socio-economic development and the need to implement state and municipal programs. Some experts suggest that we are talking about the replacement of the city master plan with two documents: a spatial development strategy, which will be a part of the strategy of socio-economic development and a comprehensive infrastructure development plan.

Thus, researching the experience of the established cities, we can say that the "smartness" of the city does not depend on its architectural image. The implementation of digital technologies takes place everywhere in existing historical cities, which allow us to conclude that the city is able to adapt to various challenges of time, including high-tech challenges, preserving its architectural "face".

5 Rational vs. Irrational

Despite such an optimistic conclusion, made above, we should emphasize attempts to create ideal "smart cities" with new architecture. The most striking example is the city of Songdo in South Korea. The project to build a new city, the technological capital of South Korea, was developed by 2002. This project was carried out by an American architectural firm KPF (Kohn Pedersen Fox) from New-York. The city is built on 600 hectares, 30 kilometers southwest of Seoul and is connected to Incheon International Airport.

It was planned that Songdo would become a symbol of technological progress with the introduction of "smart" technologies in any sphere of activity. For example, the streets were equipped with interactive panels that interact with all urban subsystems. Thus, you can remotely control literally any area of the city's economy.

Songdo's project focuses much on ecology. The car in it, is rather an exception, the main means of transportation of citizens is a bicycle. 40% of city area is covered with green planting. Also "architectural quotations" were included to the city structure such as New York's Central Park and canals of Venice.

Another name of Songdo is associated with the concept of "ubiquitous city." This means that computers are built into the entire physical structure of the city, buildings and streets. This allows residents to hold video conferences with their neighbours or even attend classes remotely [13]. They can control lighting, heating, air conditioning and many other things by the touch of a button on the control panel. Sensors collect information on traffic flows and energy use. Such information is converted into alerts for citizens when the bus arrives, or notify the authorities of the crime [14]. "Smart technologies" developed here form workplace, home, health, education, security, manufacture, transportation and ways people use energy.

In 2015, the construction of the city was to be completely finished. However, since then this date has been postponed first to 2018, then to 2022. So far, Songdo's population does not exceed 70,000 inhabitants, and its number has not been increased. On the contrary, people are leaving, and high-rise buildings built to attract promising young professionals are not even occupied by a quarter. The city lacks theatres and infrastructure related to culture and entertainment. The capital Seoul, which is 2 hours away from Songdo, is also a major competitor.

The main hopes of investors, who contributed to Songdo, are connected with the neighborhood called "American City." This area is designed to attract expatriates from different countries: USA, Canada, Germany, Great Britain, Australia. The micro-district will include 3 skyscrapers 50 storeys high or more.

Today, the city, which was intended to become the world's business center, an example of the City of Tomorrow, the "smartest city" on the planet, stuns by silence and desert. Songdo, which was to develop not just in line with the next economic zone, but as a project uniting, on the one hand, the activities of large companies, international cooperation, development and implementation of the latest advances in science and technology, and on the other hand- environmentally friendly areas, well-designed infrastructure, quality education, diverse recreation, turned out to be a city of utopia. In the perfect rational space and sterile environment of a "smart city" the irrational person cannot take root.

6 Results

An analysis of the practice of implementing the concept of the Smart City showed that today there are 4 models (Fig. 1).

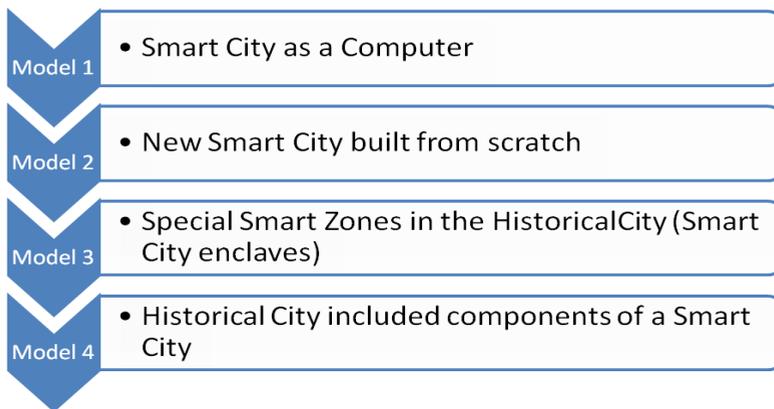


Fig. 1. Models of Smart City.

Each model offers its own form of interaction between architecture and information technology (Fig. 2).

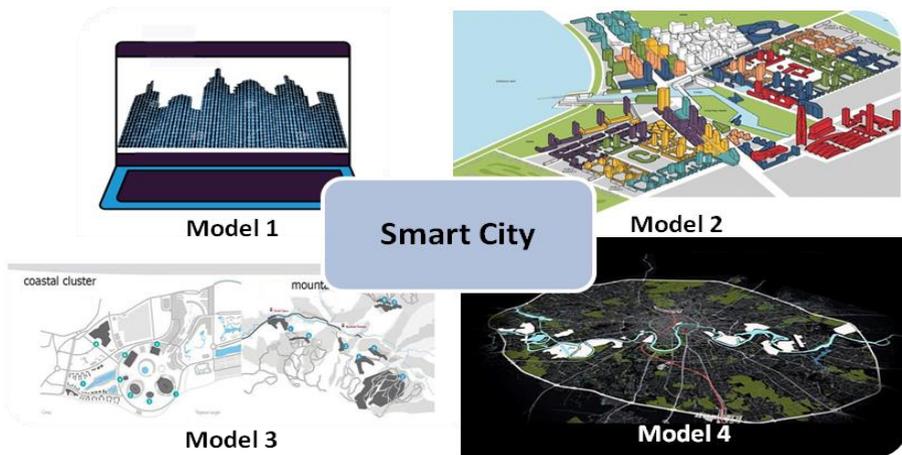


Fig. 2. Interaction between architecture and information technology in Smart Cities.

The first model "Smart City as a Computer" is rather an ideal city created by the inspiration of programmers.

The second model “New Smart City built from scratch” has quite a few examples, one of which is the city of Songdo in South Korea, where architecture and information technology form urban hybrid structures.

The third model “Special Smart Zones” involves the allocation in the territory of the historical city of smart enclaves. An example is “Smart Sochi and the Olympic Park” (Russia).

The model “Historical city” is an adaptation of the structure of a historic city for its relationship with information technology. “Smart Moscow” is an example of such a symbiosis.

7 Conclusion

The digitalization and informatization of a modern city should not become a goal in itself in the development of urban development forecasts. The Smart City concept cannot be limited to the introduction of innovative technological and informative products. The main thing in any research of urban development is person-oriented approach and correlation of management and design methods with psychology of people, their life values and goals. However, practice shows that often the discussion of "Smart Cities" is focused on use and implementation of technology, rather than on city inhabitants and on the way the new architecture will be formed. In low-income countries, smart cities are not relevant to the majority of urban population living in poverty with limited access to basic services. The trend of smart cities development can increase inequality and marginalization. We need new researches, and we need new models for thinking about cities.

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