ТЕОРИЯ И ИСТОРИЯ АРХИТЕКТУРЫ, РЕСТАВРАЦИЯ И РЕКОНСТРУКЦИЯ ИСТОРИКО-АРХИТЕКТУРНОГО НАСЛЕДИЯ

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CONCEPTUAL FOUNDATIONS OF THE POST-INDUSTRIAL CITY

The article is devoted to urban concepts - eco-city, creative city, smart city - which underlie the development of the city in the post-industrial era. The historical prerequisites for the formation of concepts are considered. The origins of each concept, which were formulated by sociologists, economists and urbanists, are analyzed. The principles of ecological urbanism, a creative city and the main characteristics of a smart city are described. A comparative analysis of the principles of each city is carried out, and general provisions are identified that are present in each of the described urban concepts. In conclusion, a description is given of the image of a post-industrial city, which is alternative to an industrial city.

Keywords: *ecology, innovations, creativity, diversity, density, compactness, identity, city image*

Статья посвящена урбанистическим концепциям – экогород, креативный город, умный город, лежащим в основе развития города в постиндустриальную эпоху. Рассматриваются исторические предпосылки формирования концепций, Анализируются истоки каждой концепции, которые были сформулированы социологами, экономистами и урбанистами. Описываются принципы экологического урбанизма, креативного города и основные характеристики умного города. Проводится сравнительный анализ принципов каждого города, и выявляются общие положения, присутствующие в каждой из описываемых урбанистических концепций. В заключении дается описание образа постиндустриального города, который является альтернативным по отношению к индустриальному городу.

Ключевые слова: *экология, инновации, креативность, разнообразие, плотность, компактность, идентичность, образ города*

A canonical image of the modernist industrial city was presented in the Charter of Athens. All aspects, such as work, housing, leisure, and transport, were described in detail, and Le Corbusier's early sketches and plans today appear like a copy of reality. For several decades, this image has been implemented everywhere. Thanks to clearly enunciated principles and massive housing construction, all such implementations copied each other, creating an endless series of identical illustrations of the original provisions of the charter. Perhaps, this was one of the main signs of the coming global era. After the collapse of the hopes of the modernists and after the collapse of the modernist industrial city, many concepts appeared, which were often fantastic and sometimes, on the contrary, rooted in the historical past. However, for a long time, no general principles were similar to the Charter of Athens through which the outdated and compromised ideal of the modernist city could be replaced. The authors of the projects, plans, and strategies contradicted each other. Between the walking cities of Archigram and the urban artifacts of Aldo Rossi, an indefinite present existed that did not receive its visual and structural representations [1]. It was impossible to find a golden mean despite the principle of collage proposed by C. Rowe and F. Koetter [2]. The future city was assumed as a city where the past and the future should coexist in the present; however, the question on how this could be linked meaningfully, other than by combining contrasting and heterogeneous structures in an urban collage, remains.

While architects and city planners were looking

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for an image of the future, various processes gradually developed in real cities. The transition from an industrial to a postindustrial city led to the decline of industries, which was the basis of modernist urban planning. The very semantic centers of urban life have disappeared, gradually being replaced by other production methods and increasingly becoming estranged from the traditional structure. Simultaneously, the "green" movement for environmental well-being in cities was gaining momentum. The market economy and consumer culture changed the very concept of the city center, which was increasingly given over to trade, penetrating all vacant spaces. In contrast, public space has been increasingly privatized and reduced, which has caused concerns among citizens and urbanists. Finally, the development of information and computer technologies transformed the world, which now appeared to humanity in two dimensions, forcing them to adapt to constant immersion and functioning in virtual and real environments simultaneously. The global world has contributed to constant movement, giving rise to a generation of nomads following economic trends and rethinking the urban environment.

These radical changes have prompted many philosophers and sociologists, architects, and urbanists, as well as economists and city managers, to rethink and analyze the ongoing processes and to search for approaches capable of coping with continuous change. In turn, the development of strategies required the formulation of principles and, therefore, the definition of values, which could be used as the basis for specific plans. Therefore, first, developing a new description of the coming time was necessary. This description was given by Daniel Bell in the book "The Coming Postindustrial Society," which was published in 1973 [3]. Bell showed at an early stage how the production system and economy are changing, and how society is moving to a new stage of development, which, in turn, gives rise to requirements for the organization of space. New concepts of the city were required to replace the concept of the industrial city. Three new concepts (ecocity, creative city, and smart city) became keys in developing urbanism, as they expressed, both the city changes themselves and new values in a postindustrial society.

Ecocity

The concept of an ecocity is a continuation of the permanently existing problems of urban planning, which centers on the idea of harmonizing the urban environment and the natural environment [4]. Although modernists proclaimed green space as one of the most important principles, the facts on the ground in cities demonstrated an acute shortage of public green spaces, poor ecology, and the absence of coherent, clearly enunciated green infrastructures. Industrial enterprises destroyed natural systems, and in reality, the image of "towers in a park" represented free-standing buildings in a disorganized landscape. Different ideas, such as green city bourbonism and bioregionalism, involve turning to the natural resources of the city as the basis for the economic development of the city and region. Proponents of these approaches imagined the human community as a part of the global natural system. The most notable movement was the nonprofit organization Urban Ecology, founded by Architect R. Register in Berkeley in 1975. R. Register developed the concept of the Berkeley ecocity, pioneering such a definition of the city. The book Ecocity Berkeley: Building Cities for a Healthy Future became widely distributed and served as a guide to the development of sustainable urban spaces [5]. International conferences organized by the architect attracted many participants and spread the ideas of ecocity in many countries.

The first ecocity projects were based on the desire for a communal lifestyle, use of ecological building materials and energy sources, development of cycling and pedestrian traffic, and an increase in green spaces. Nevertheless, some of their initial patriarchal characteristics were transformed under the influence of information and computer technologies and the adoption of the UN concept of sustainable development, which served as a new impetus for the environmental transformation of cities [6]. Three significant vectors have emerged: the ecological renovation of historical cities, creation of new ecodistricts in European cities, and construction of technologically advanced ecocities in Asia based on new innovative methods. Germany, Sweden, and Finland are leading in the construction of ecodistricts in Europe, where nature has traditionally played a significant role in the national culture. In Asia, ecocities are the most actively constructed in China, South Korea, and Singapore.

The definition of an ecocity includes many concepts that vary according to the geographic and cultural context. Regardless of whether ecodistricts are the result of the renovation of existing places or represent new innovative projects, they all share the following principles of ecological urbanism [7]:

1. Integration of natural and manmade environments. This means that the territorial context, landscape, and climate are key factors influencing the planning structure of the city. The uniqueness of each context ensures that the negative effects of weather conditions are minimized and benefits are taken from the existing landscape. The natural potential of a territory becomes the basis for economic and social development.

2. Compact city shape. Enunciated boundaries prevent the chaotic sprawl of the urban structure and predominance of low density in city development. This enables us to optimize traffic and create high throughput of the transport frame. The preservation of the natural landscape seems to be the most important aspect, which provides

opportunities for the development of agriculture, food autonomy, and priority of local products. The compact form and high density also provide opportunities for the development of cycling and pedestrian traffic and walking distance to all public facilities and spaces. The compact form allows the rational use of the city territory, leaving no voids and preventing the degradation of individual areas and places.

3. Green frame of the city. The interconnected green spaces, like a transport frame, make it possible to create a continuous green environment in the city, consisting of clearly enunciated components with their compositional and formal diversity. All citizens have access to green spaces. A green framework allows for the creation of a city's biodiversity by integrating green spaces within the city with the immediate natural environment beyond it, leading to greater sustainability.

4. Reduction in vehicular transport. Ecocities prioritize public transport, cycling, and walking. The use of motorcycles, which are cheap and accessible motorized vehicles, is also common in Asian cities. Rail transport is developing because this mode of transport is more environmentally friendly. The number of electric vehicles is expected to increase.

5. Circular economy. An ecocity uses green technologies to manage energy, water, and wastes. Biological wastewater treatment, wastewater collection in storage facilities, various renewable energy sources using local resources, and smart metering technologies are used. Particular attention is paid to recycling resources and reducing waste and toxic emissions.

6. Use of local materials in construction. The production of materials must be environmentally friendly and economical. The use of local materials shortens supply chains, minimizes energy costs, and ensures an urban identity. The development of new materials should be based on the possibility of their subsequent processing and reuse.

7. Construction based on modular structures and energy-efficient technologies. Modular designs contribute to an increase in affordable housing. All public buildings in an ecocity should be designed for flexible applications, and their various components should be transformable and reusable, ensuring a long life cycle. When developing facades, adaptable shells that can automatically change the temperature regime and regulate ventilation processes should be used. Energy-efficient technologies can change the process of energy consumption, turning the site into a source of energy, whereas water collection and purification systems reduce the consumption of water resources in the city.

8. Developed public space. In an ecocity, the planning structure is polycentric. Business and public functions are concentrated in the centers and subcenters. In historical areas, public space is the result of the renovation and adaptive use of former industrial buildings [8]. All public spaces are accessible by all populations, including those with limited mobility, and provide opportunities for various activities that contribute to strengthening neighborhoods. Similar to the green frame, public space in ecocity connects all areas, which is achieved through mixed use.

9. Diversity is the guiding principle, which is implemented in structural planning and development, green and public spaces, innovative technologies, and materials of the ecocity. Innovative technologies and local culture stimulate economic prosperity. Functional and visual diversity define a city's uniqueness and strengthen its urban identity.

Thus, the concept of an ecocity involves not only an increase in green spaces but also a transformation of the planning approach, development of innovative technologies, and stimulation of the social life of citizens. High-tech Asian ecocities are inferior to European cities precisely in terms of the development of public functions and affordable housing. Modern experience in the construction of ecocities demonstrates that closed-cycle technologies insufficiently provide a comfortable environment, and the socioeconomic, planning, and functional structure of the city must change in accordance with the values that were formed during the development of a creative city.

Creative city

The concept of a creative city began to develop a decade later than that of an ecocity. In the 1980s, the consequences of the transition from an industrial to a postindustrial economy in cities became increasingly noticeable. Many industrial enterprises were abandoned. The structure of employment has changed. The working class was displaced by new workers in the finance and service sectors. The new creative class, as defined by R. Florida, imposed different requirements on the urban environment and the quality of urban life [9]. These demands coincided with the city authorities' new interest in culture and art, which increasingly played a significant role in the life of the creative class and postindustrial economy, where design and advertising were an integral part. Culture and art began to be perceived as new drivers of the economy, which can change the face of the city and make it attractive not only for developing tourism but also for the influx of workers in intellectual and creative professions.

By competing with each other, cities were transformed through the construction of iconic objects such as museums of modern art or cultural centers. The idea of reuse, stemming from an ecological approach, was applied to the adaptive use of industrial sites, which began to be transformed into creative clusters. Cultural and creative industries received spaces in the urban environment, and degraded areas became significant public spaces. Very often, creative clusters located in unused buildings became the

basis for the subsequent gentrification of working-class areas, attracting public attention and thereby increasing the value of land and future housing development. A similar process of attracting citizens and tourists occurred in the construction of a new museum designed by a famous architect, such as in Bilbao or Barcelona. Such an object has become a new urban icon, shaping the modern identity of the city.

Culture and art, which previously occupied a marginal role in the urban economy, have come to the fore in postindustrial society. The development of creative clusters and contemporary art occurred simultaneously with the reconstruction of the historical environment, which also improved the quality of the urban environment and attracted tourists. All these processes formed the basis for the concept of a creative city, which was developed by Charles Landry, one of the authors of the postindustrial transformation of Glasgow. Based on analysis and his own experience, C. Landry, in the book "Creative City" [10], formulated provisions that can be accepted as principles of a creative city.

1. *Culture as a resource*. Throughout the history of civilization, creativity has been the driving force behind urban development. Moreover, culture becomes the basis for creativity because intellectual and creative forces are always involved in creating novelties. Thus, culture can be defined as a key resource in economics and politics. Culture preserves all ideas developed by society and is the material for subsequent development. Cultural resources determine the degree of creativity, which functions as a method. Cultural resources include historical heritage, urban environment, festivals and local cuisine, all cultural institutions and tourism, as well as all creative forces of the city that strengthen social capital.

2. *Innovation as a result of creativity*. Innovation arises when ideas are generated at the intersection of various traditions and their transformation and adaptation to new conditions. Thus, creativity ensures the mutual influence of tradition and innovation. Creative practices enable us the transmission of cultural values and prevent homogenization caused by global development. Innovation in all spheres of urban life is possible, thanks to the increased creativity of the entire urban community [11].

3. *Diversity as potential for innovation*. Since innovation arises from the hybridization of different ideas and practices, their stimulation requires priority to diversity in culture, economy, technology, social structure of the city, and its methods of management, architecture, and art. The higher the degree of diversity of inputs, the more innovation can be achieved in a creative city. Thus, diversity becomes an inexhaustible resource, generating a trend for innovation in all fields.

4. *Importance of the local context*. Each context is unique and determines the specifics of cultural resources, features of economic and production structures, and therefore the specialization of the city as the niche it occupies in the culture and economy of a region or country. Accordingly, context influences innovations that may be implemented in one city and irrelevant in another. Local traditions, practices, and events shape the city's identity. Therefore, the local context must be carefully analyzed, and the aspects constituting local identity strengthened.

5. *Importance of the creative environment*. Creative people are the initiators and drivers of innovation, for whom the existence of a creative environment is important. Thus, various individuals, groups, teams, government, commercial, and public organizations must be united, ensuring constant dialog between all members of the urban community and turning urban development into collective creativity. Different opinions and points of view of citizens and external experts determine a more complete picture of the analysis and provide both knowledge of the local context and knowledge of the changing world, which allows the creation of a city development strategy. If in capital cities, a creative environment always exists as part of the metropolis culture, then in regional centers and small towns, the creative environment must be developed, and opportunities must be provided for its creation where it does not exist, encouraging formal and informal connections and dialogs.

6. *The city as an organism*. All processes in the city develop dynamically; therefore, the development strategy must consider the ongoing changes, emerging innovations, external conditions, and growing diversity of technologies, influences, and cultural and social resources. All this enables us to shift the focus from the idea of the city-machine with its rigid bureaucratic and industrial structure to the idea of the city-organism, which implies the recognition of continuous change. The city-organism can respond flexibly to changes, adapt to them, and constantly improve all aspects of city life. The idea of a city-organism best suits the understanding of the modern world with its increasing complexity and dynamics.

Motivation must launch a creative city project. This usually occurs under the influence of external factors such as an economic crisis caused by internal or external factors, emergence of problems that cannot be solved by traditional methods and require the invention of new approaches and solutions, an unfavorable environment requiring reorganization and restructuring, and modern urban competition. Consequently, creative practices that involve the possibility of creating alternatives, searching for options, and unexpected solutions are becoming the most sought-after. All these practices have been developed in a modern, innovation-oriented culture. When such practices are integrated into the city's development strategy, a creative cycle can be launched in the city, where innovation will be implemented in parallel in all fields. Receptivity to innovation

is an attribute of urban culture, demonstrating a certain level of its development. However, this quality can be introduced from the outside based on the introduction of the values of the concept of sustainable development, which provides for the need for changes in urban thinking.

Examples of creative cities demonstrate that the transition from rigid plans to flexible strategies and a focus on adapting to changes enable the finding of unique solutions for each case [12]. However, in every successful creative city, development is based on the above principles. The priority of culture as a resource, basis, and incentive for the innovative development of the city provides new opportunities and enables the invention of new methods to improve the standard of living of citizens, improve the quality of urban infrastructure and environment, and therefore increase the attractiveness of this city for new residents. Even a small group of innovators can transform the creative environment in a city, launch the process of creative development, and turn a deteriorating city into a prosperous one.

R. Florida described the requirements of the creative class for the city. Creative people value the unique urban environment, unconventional spaces to work and live, rich social life, and street diversity associated with urban culture, such as cafes, bookstores, galleries, concert venues, local community, walking areas, and bike paths. All these places become tangible creative environments for innovators because they require visual and spatial stimulations. Traditional cities with traditional office spaces and typical residential developments cannot attract the creative class. This means that a city seeking to attract the creative class must accumulate the values of urban culture, which will become a resource for its development. The creative city and creative class are two sides of the sustainable development process.

Smart city

The development of information and computer technologies (ICT) since the 1970s led to the a considerable number of projects for the future, based on the belief that ICT can change traditional production, economy, and living environment, the city. Predictions that the virtual environment will become an everyday reality have come true [13]. However, at present, virtual and real spaces do not exist separately but are intertwined with each other, creating a common integrated environment. Such an environment is defined by M. Castells as a "space of flows" relating to both material and intangible environments [14]. M. Castells and P. Hall [15] developed the concept of an innovation environment, which, as they argued, is characterized by creating synergistic influence and extracting energy from the interaction of territory and technology. In such places, a technological infrastructure is developed, which connects all flows, and a spatial organization of elites that ensures personal interaction. In subsequent years, the idea of combining technologies and territories began to receive its real embodiment, which prompted D. Gibson, D. Kozmetsky, and R.V. Smilor to formulate the definition of "smart city," which stemmed from their analysis of American technopolizes [16]. The authors demonstrated that in all cases, there is a public–private partnership that stimulates urban development through technological innovation and the commercial sector. The Smart City thus became a highly sought-after model and concept that defined urban strategies aimed at transforming cities to the changing world of technology. When developing the "smart city" concept, three approaches were developed: (1) the technocentric approach, which prioritized ICT in urban development; (2) increasing social capital; and currently, (3) the integrated approach, which is widespread and involves improving the quality of economic and cultural life through the balance and interaction of technological and social innovations. Not only have technological innovations become significant in themselves, but the contribution of ICT has become valuable, which contributes to the emergence of smart communities, thanks to which cities are transformed. For example, smart cities meet the concept of sustainable development by combining economic, social, and environmental aspects and providing a comfortable urban environment.

R. Giffinger described six characteristics of a smart city that determine the quality of life [17]:

1. A smart economy generated based on innovation is developed through "smart" production based on ICT.
2. Smart people make up social capital. They are highly skilled and produce innovation.
3. Smart management is a characteristic of administrative systems that provide management based on innovation.
4. Smart mobility is responsible for accessibility, logistics, and safety in transport systems.
5. A smart environment ensures environmental protection and ecological balance of the city.
6. Smart living determines the quality of life in health, education, housing, culture, and tourist attractions.

The ranking of cities is based on these characteristics. Today, the infrastructure of any city includes physical structures, information technology, and services. In a smart city, all physical infrastructure is managed based on ICT, which is the key resource of the city, ensuring the interaction of all networks and systems. There are several city-forming components of a smart city.

Smart buildings are equipped with sensors, have software, and regulate resource consumption, thus increasing the energy efficiency of the building. Smart transport includes communication and navigation systems that integrate all types of transport into a single system and provide the shortest routes, automation of fares, and mobile applications for citizens. Smart energy is based

on intelligent energy production, including grids, transmission, and storage.

Intelligent transport systems provide navigation, fees, and interactions for all types of transport. Smart transport is becoming an important part of the urban structure, which promotes the accessibility of any type of transport, ease of transfers, route selection, and administrative control over safety. Mobile applications for taxis reduce the cost of this transport type for citizens and allow them to choose the quality and level of service.

Smart energy in cities includes systems for distribution, consumption, storage, and metering of energy consumption, minimizing costs through the use of various sensors and smart networks with regulated tariffs. This allows the use of renewable energy sources and synchronization of processes from all types of energy, including wind, thermal, and photovoltaic energy.

A smart healthcare system allows for the collection, storage, and analysis of constantly updated data, allowing doctors to adopt treatment protocols using various methods. In addition, telemedicine makes qualified medical care accessible to all city and rural residents, regardless of their place of residence. Connecting older people and people with disabilities to a smart healthcare system provides timely assistance and care, improving their quality of life. Thanks to mobile applications, citizens can make an appointment with any specialist at the right time, reducing personal presence in clinics.

Smart education includes all types of educational institutions in a single system that helps citizens enroll their children in kindergarten and school, apply to colleges and universities, gain access to online education, and take advantage of systems of supplementary education and advanced training. Smart education provides children in remote areas with access to interactive lessons from top teachers and learning materials.

The Internet of Things connects all energy systems, sensors, computers, and other smart devices on the network, enabling information collection and storage, control and monitoring, messaging, and actuation. All big data are processed and systematized, increasing the efficiency of the smart city. Thus, in a smart city, all systems are in constant interaction, combining all types of intellectual resources and structures.

Conclusion

At present, every city strives to implement all three concepts in its development. Each of the concepts considered, eco-, creative, and smart cities, intersects with the other in many ways. By analyzing the principles, characteristics, and features of each concept, the development of one innovative strategy in urban planning immediately leads to the emergence of another, stimulating the continuous innovative process of development of a postindustrial city. The postindustrial city is gradually acquiring its own image that is completely different from that of the industrial city. The key principles of a postindustrial city are environmental friendliness, technological effectiveness, diversity, high density, compactness, and strong urban identity. The postindustrial city is dynamic. Its urban strategy involves constant adaptation to changing conditions and development based on creativity in all fields. Unlike the industrial city-machine, which follows the same routine, the postindustrial city is a city-organism that can transform in accordance with new requirements and innovations. Culture and history in a postindustrial city play a key role not only in defining urban identity but also in promoting the adoption of innovation and enhancing creativity as a main factor of development. Smart technologies provide a high level of environmental friendliness, which is expressed primarily in the use of renewable energy sources, smart water treatment systems, regulation of resource consumption, reuse, and increased energy efficiency, which leads to the biodiversity of green urban spaces and an increase in the comfort level of the urban environment. The interaction of all intelligent city systems allows for effective city management, creating a high quality of life for all citizens. This results in diversity, which is the main quality that distinguishes a postindustrial city from an industrial one, from the diversity of the urban environment, buildings, jobs, social and cultural life, and public spaces to the diversity of traditions and innovations, technologies, and creative practices at all levels of the city. The multilateral and multidimensional diversity in each case determines the uniqueness of each city, which in itself is a key urban value.

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