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URBAN PLANNING ARCHITECTURE

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Statement of the problem. New challenges of our time and the dynamics of socio-political and socio-economic factors in the development of Russia significantly affect the methodology of urban planning. The deteriorating environmental situation in many cities encourages a new approach to understanding and developing new principles of city life that regulate the biosphere compatibility of cities and the development of human capital as the main criteria for the effectiveness of territorial planning, construction and operation of urban facilities.

Results. The article deals with a fundamentally new approach-urban planning, which should be understood as a system of fundamental provisions on life in the territories of cities and settlements and the principles of their spatial development and settlement. In practical terms, urban planning is an activity for the internal arrangement of the city's living environment, creating favorable conditions for the life of all categories and strata of the population without exception. The fundamental differences between the concept of urban development and urban planning are related to the need to understand the unity of the city and Nature, the symbiotic "embedding" of the city in the Biosphere. The Central element of the concept of urban development is the person, the conditions for its development in the urban environment.

Conclusion. As part of the research, the practice of urban planning allows solving the problems of innovative development of the urban economy and increasing human potential, and in the long term — transforming cities into biosphere-compatible and developing people as an alternative condition for the survival of humanity and a priority for its development as an intellectual community.

Keywords: urban structure, architecture, comfort, eco-socio-technogenic safety, life environment, functions of a biosphere-compatible city, innovations.

Introduction. In some terms such as “building architecture”, “ship architecture”, the term “architecture” looks at the object itself and its internal structure more profoundly. The architecture of “urban planning” is also interpreted from the same standpoint — a concept that

emerged in the Russian Academy of Architecture and Construction Sciences (RAASN) [9] about ten years ago. It acts as an integral response to the radically changed circumstances in the world over the past half century. Let us list those.

Since the mid-1970s, the world has entered the fifth technological cycle of Kondratiev [13] which is characterized by nano-genetic-bio-information technologies and is now about to be over with a phase of crisis. The Soviet Union did not participate in this cycle, and the country was technologically lagging behind by 50 years. The result has been a lack of intelligence and tangible industrial results in these areas. The sixth cycle of Kondratiev, called the “new world economic order”, is set to begin in 3 or 4 years with the “revival” phase. According to the theory, it is characterized by riots, revolutions, wars, intercivilizational confrontations, etc.

Since the mid-1980s, it has become daunting for the Earth's biosphere to neutralize the toxic waste of human activity. In the 2000s, such neutralization required 1.2 globes, and in 2019 — 1.6. This man-made problem is extremely severe, and unless timely addressed, there might be a one-time biosphere catastrophe in the coming decades following which life on Earth will be extinct [7]. This will happen prior to the depletion of the minerals and the end of the 100-year life of the building.

In most of the European territory of Russia, in the Urals, the 7th rank of ecological hazard is recorded with large Siberian cities experiencing a “tense” ecological situation [11]. Put differently, the threat is impeding as it has been here for many years: nature is degrading forcing people to degrade causing it to follow the suit. The result sounds bizarre: in the world's largest country with an average population density of 8 people/km² (26 people/km² in the European part and 2 people/km² in Siberia) almost all of them live in varying environmental conditions [30].

According to the UN data published in 2019 [19], Russia has the following indicators: according to the human development index it is ranked 49th, in the ranking of countries by the level of social development it comes 62nd, by the level of “happiness” it is in the 68th position, by the level of life expectancy in the 109th position respectively. However, it is generally accepted that the human potential of a country is the guarantee of its successful future ahead.

The problem of the survival of mankind is the most critical one. Research aimed at creating a new paradigm of urban planning as a theory and practice of human life in urbanized areas seems highly relevant.

The objective of this work is to develop scientifically grounded principles and a multilevel model of self-development of a socio-natural-technical system of a biosphere-compatible city.

1. The major provisions of the Doctrine of Urban Development. Let us emphasize the fundamental features of the Doctrine of Urban Planning [10]. It is based on the recognition of human needs considering only a certain part of their infinite variety, conventionally called “rational needs”, and projects them onto the city by analogy with human proportions in classical architecture. Therefore the responsive functions of the city are identified satisfying human needs from environmental to the needs for comfort and safety, while they are estimated numerically. The doctrine of urban development proceeds from the need for “awareness of the unity of mankind and nature”, “symbiotic integration of the city into the biosphere” employs the concept of “human development”.

In urban planning the concepts of “settlement of a territory” and “development of a territory” are not applicable as this or that part of the natural area was definitely going through some stage of development. Also, the concept of “natural frame of the territory” as a set of the most active and environmentally interconnected spatial elements has lost its primary importance. This is due to the fact that this concept had been brought down by the world era of industrialization, and now whatever is left of it is being destroyed in cities.

The word “city” in this context is employed instead of other names of settlements and is applicable to any of them ranging from a farm to an agglomeration.

The current situation in cities calls for adoption of managerial solutions on considerable innovative improvement of the urban ecological state. This is evidenced by the Presidential Decree from July on the creation of a comfortable and safe living environment in urbanized areas [26]. Today there are sufficient scientific debates on the problem in various forums and scientific publications. Nevertheless, the analysis of studies pertaining to the use of innovations in the urban planning sphere of activity enables us to draw attention to the fact that the overwhelming number of them are aimed at accounting for new social phenomena in construction [25], architecture [27, 31, 33], urban design [5], urban studies [35], the concept of “health preservation” [32, 34], architecture and construction education [23]. The meaning of the professions such as “architect”, “engineer”, “urban planner” is changing dramatically. They are becoming far from functioning in this or that activity. The concepts of these professions no longer describe a person as an element of nature in the socio-natural-technical system, which a modern city should inevitably become within the framework of the general paradigm for the development of biosphere-compatible or “nature-like technologies as the future of the global economy”.

2. The principles of the doctrine of urban planning. The implementation of functions, mechanisms and programs of self-development of urbanized formations can be provided by

means of the principles of the modern paradigm of transforming the city into a biosphere-compatible and human-developing mechanism. These principles have been formulated in the last decade in the RAASN in relation to the architectural and construction industry [9, 10]. All the principles are based on nature which is seen as superior to human in value with the latter being no more than its element that must serve their mother's body.

The first principle of city development should be the awareness of the unity of human and nature. In this case, any action against nature is perceived as particularly hazardous, and the spatial development of city territories without considering the interests of nature, even using the most advanced technologies is becoming detrimental to the environment and humans. The assessment of the direction of development itself, both based on the paradigm of biosphere-compatible technologies, and with a much more general approach developed in an extraordinary study [20] should rely on fundamentally different criteria and other tools. The fundamental concepts that define modern urban ecology, urban planning and architecture are certainly included in the principles of urban planning formulated by the RAASN and scientifically substantiate and explain the changes in the modern boundaries of the spatial expansion of cities but fail to solve the problems of development in various spheres of the city's life. The concepts of this principle presented in [9, 10] are associated precisely with development. They come into contact with Philosophy, Sociology, Ecology, Technology, Economics forming the concepts of “comfort”, “safety”, “improvement”, “expediency”, etc. on their basis. Along with these new concepts, those of professional knowledge and the carriers of this knowledge themselves are being transformed. As rightly noted in [2], the new stereotypes and basic foundations of the profession of the architect today are creating a false effect of its general availability and architecture in this expanded space is currently considered a commodity [27]. The very definition of an architect, i.e. the main builder, in the context of globalization and the emergence of new stereotypes, is dismembered into separate parts, thus stripping the profession of its specific essence.

The next principle is that of dualism and duality. In the context of the first principle, it correlates with the influence of human on nature (pollution of the biosphere) and with the influence on himself (life in a poisoned nature). In the urbanized environment of the city, dualism manifests itself both externally (the impact of the city on nature) and internally (the level of health of the inhabitant broadly: spiritual, physical and social one). The state of this health cannot improve only if so do sidewalks and adjacent spaces, which is understood and prescribed in the guidelines on creating a comfortable environment. Here all the functions of the city are

implemented: decent life support, quality medicine, education, protection of socially unprotected segments of the population.

Using the correlations between the manifestations of the external and internal in a particular urbanized area, one can move on to quantitative characteristics. In this regard, the third fundamental innovation is the triple balance between the number of the population, the places where its needs are met and the vitality of the biosphere. Some facts from the history of our nation can be called a successfully tested basis of this balance: e.g., industrialization in the first third of the XX century, which created a balance of labor and jobs at the stage of economic recovery following the Great Patriotic War. In this case, the impact of the withdrawal of natural resources and emissions of waste polluting the biosphere were not taken into account. As a result, the situation for our country did not become comforting: for example, there are practically no living trees within a radius of 100 km away from Norilsk [14], and in the city of Severodonetsk it was hard to breathe before the industry stopped due to the toxicity of the atmospheric air [29].

The fourth principle most broadly determines the state of the regulatory framework. It should be aimed at improving the environmental situation, or at least maintaining it in its current state even when new industries are being created. This means that it is not necessary to exceed the already established consumption of land, clean water, oxygen and energy. The minerals and biological tissues of the earth cannot be simply mined; their restoration must be funded. The regulation of the removal of planetary tissues with the help of the regulatory framework is in full compliance with the new paradigm of self-development and safety of cities, society and the state: economy, ecology and energy as factors that are central to the “health” of nature and human as its element. On the one hand, in the age of a new energy paradigm, energy is central to the quality, variety of public goods and the level of development of society. On the other hand, the technologies employed for the extraction, processing and storage of energy no longer ensure the consolidation of the existing ratio of the extraction of natural resources and throwing of waste from economic activities. There is a need for urgent radical changes in the technologies of the world energy sector largely focusing on the development of its low-carbon industry. A lot of wealthy European countries are embarking on this path. E.g., Germany is in the process of developing program plans in order to bring the volume of renewable energy sources up to 50 % [8]. Russia currently has no such indicators, but there are other proposals in place for creating a self-replicating “balanced powerful cluster from the generation of science, industry and education”.

The fifth principle is the principle of knowledge as the basis of any development, including human development in various territories. Just like the awareness of the unity of nature and

man, this principle determines the methodology for achieving goals through programs for addressing city problems. Here, as a result, the so-called platforms, clusters should emerge, but only in parallel with built-in mechanisms for implementation of these programs using program-targeted methods and various funds [12, 15]. However, the experience of creating and operating foundations in Russia did not have a sufficient legislative base. Nevertheless, under the conditions of modern Russian tax legislation, when, e.g., each organization that creates its own part of the total product pays VAT along with payment of the same VAT by the general contractor, it is impossible to ensure a competitive cost of the final product [17].

Given the fact that the city is the most complex socio-natural-technical system, its scientific management is possible based on interdisciplinary knowledge. If a social system (about individual well-being and group behavior of people) is discussed, knowledge from philosophy, sociology, psychology, culture studies and other disciplines must be jointly employed. In discussions about nature, it is essential to investigate the disciplines of the natural history block. The analysis of a technical system implies knowledge of many technical disciplines [3, 28].

An example of the implementation of interdisciplinary knowledge and technologies is the projects of the Italian architectural bureau *Stefano Boeri Architetti* which while designing the buildings of *Bosco Verticale* in Milan sought to be natural including trees and plants in the project of a high-rise building (Fig. 1).



Fig. 1. Bosco Verticale buildings, Milan, Italy

(source: <https://www.pinterest.ru/pin/561894490980258984>)

The number of trees in the building is over 21.000. Green spaces located on balconies not only absorb carbon dioxide converting it into oxygen but also trap atmospheric pollution, reduce noise impact, and also bring aesthetic pleasure, particularly in contrast to modern buildings made of steel, concrete, stone and glass.

The sixth principle relies on the concept of traditional statistical indicators of development: they must ensure that the state of the city is checked, i.e. how, as a result of the implemented programs, the city has changed according to all the statistical data. Additionally, the indicators are designed to show how the human potential of city residents has changed, i.e. how the dualism was implemented in the influence of the city (human) on nature and how the health level of the city residents has changed as well.

The above principles create an external environment for the implementation of the seventh principle, i.e., city functions. It starts at the stage of urban planning. As according to the RAASN urban planning paradigm, all city functions are a response to human needs (projection of a person onto a city), they should be implemented considering the normalized territorial accessibility for each resident of a particular residential building, group of houses, quarter, microdistrict, district and the entire settlement. These functions can be implemented both according to the scheme of the territorial principle of spatial development of a designed or reconstructed specific territory of a residential building, quarter, microdistrict, district, and according to the scheme of vertical embedding into a multi-storey building of the required infrastructure with an appropriate set of internal spaces. Here it is essential to carry out paired functions of the first level (quarter level), such as “life support - connection with nature”, “entertainment and leisure – creativity”, “power – knowledge”, and the function of “mercy” (with no pair). Both in the first and in the second case, there must be an infrastructure ensuring the implementation of all the above functions in the minimum volume providing for the requirements of walking distance.

The implementation of all the functions for the next level — that of the microdistrict — is provided during the development of the project for the planning of its territory, design of residential buildings, courtyards, objects of territorial infrastructure and recreational spaces. At this level, the components of the district level are added to the structure of functions. So, e.g., if the implementation of the function “connection with nature” at the level of a project of a particular residential building is ensured by landscaping the courtyard, at the level of the microdistrict, green recreational spaces are provided in the form of squares and other recreation areas. Implementation of the “life support” function for the “trade enterprise” component

at the microdistrict level is not limited to stores with everyday items but includes the construction of multi-purpose trade centers. The implementation of the “leisure” function, in addition to placing benches at the entrances of residential buildings, implies a wide range of recreational infrastructure for residents of the entire microdistrict.

An even more expanded range of constituent functions of the city should be designed and implemented at the level of the city district and, moreover, at the level of the entire city. E.g., the implementation of the “knowledge” function within a microdistrict can be provided by pre-school and school educational institutions, but already at the city level this function is provided by the presence of secondary and higher educational institutions. The function of “entertainment and leisure” at the city level is implemented by means of the design and construction of theaters, circus, philharmonic society and cannot be limited to built-in premises in residential buildings (e.g., for a chess club or hobby groups).

If planning and development projects of microdistricts in Russian cities are analyzed from such a standpoint, a conflict of interests between investors and city residents is clear. E.g., performed based on the methodology [1], the calculation of the level of implementation of city functions in the new microdistrict “Silver Hills” under construction in Kursk (Fig. 2) showed that the value of this relative indicator is 0.23.



Fig. 2. General view of the planning of the microdistrict “Silver Hills” under construction in Kursk

At the same time, for the overall city, this number is 0.52. It is also important to note that the requirements of all the current regulatory documents of the city of Kursk pertaining to the design of the microdistrict are almost met. Therefore the current territorial urban planning norms

of Russian cities do not provide for a lot of constituent functions of a biosphere-compatible city contributing to human development.

The possibility of implementing all the functions of the city is ensured by the development of urban construction plans or, more commonly, master plans. They should contain everything that the locality of its resident is expected to provide. Everyone living in any settlement ranging from a farm to a large agglomeration must be able to enjoy a decent life support, education, medicine as well as a comfortable and safe living environment.

Considering a favorable living environment from the standpoint of city functions, attention should be drawn to the framework of the concept of biosphere compatibility by the chief architect of the Institute of S. V. Nepomnyashij [18]. The author of the concept of ecological reurbanization and the method “Heliotecture” suggests arranging multi-level public spaces around a residential building or a complex of houses to accommodate related structures, i.e., kindergartens, shops, swimming pools, gyms, offices, etc.

The advantages of this concept are obvious: without having to go outside, residents, satisfy their daily needs, there are new jobs, pendulum migration drops, savings in heat and cost of engineering systems are due to compact placement, parking lots are being designed over the entire complex as well as public transport stops, interior spaces are lit by atrium or flat mirrored light guides, etc.



Fig. 3. Block-house Wave in Shantou (People’s Republic of China)

An example of such a block-house, which gives a better insight into possible construction in the conditions of superdense development in the Chinese city of Shantou, is shown in Fig. 3.

The solar cluster concept is applicable to small towns. In Fig. 4 and 5 there are floor plans, general view and atrium part of the village according to the Semiozerka project in Tatarstan.



Fig. 4. General view of the settlement according to the Semiozerka project in Tatarstan



Fig. 5. Atrium of the settlement according to the Semiozerka project in Tatarstan

The following principle meets the needs of the mass consciousness of city residents in public contacts [21]. Its implementation can also manifest itself in two ways: either to contribute to a friendly, comfortable environment, or to be implemented negatively pursuing other, some-

times opposite, oftentimes hidden goals. A striking example can be professional education [22], e.g., in the previously discussed architectural and construction sphere. Formal and technical means and the illusion of learning along its own trajectory transform professional communication into a ball of isolationism where the ultimate goal of the profession is blurred. There are multiple examples when an architect's training and, moreover, a city planner's is reduced to three-month courses [6] and is fairly official according to educational standards. In view of the ease of achieving the goal, this is supported by student youth. An increasing number of narrow, "pixel" specialists and preachers of amateur architecture appear under the guise of slogans about modernity and cutting-edge [16].

The final principle is "safety". This is about eco-socio-technical, not military security.

Conclusions. The principles of urban planning have been developed and structured, and a multi-level model of self-development of the socio-natural-technical system of a biosphere-compatible city has been set forth.

Within the framework of the paradigm of self-sustaining development of urbanized territories, a new interpretation of the functions of a city as a "projection of a person" onto it is revealed. Proposals are presented for a quantitative assessment of the triple balance in an urbanized territory and for a method for calculating the level of feasibility of the functions of a biosphere-compatible, safe and comfortable city.

The above principles of urban planning are aimed at designing mechanisms that block false or hidden goals leading to incorrect results, to the absence of dualism and the appearance of one-sidedness in assessing phenomena. It is shown that the absence in development programs of a quantitative assessment of the existing triple balance or imbalance does not make it possible to respond to new challenges of a technogenic and natural market in a timely manner.

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