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CHALLENGES TO GREEN SPACES IN MODERN CITIES

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ABSTRACT

Accelerated rates of urbanization suggest that by 2050, more than 70% of the world's population will live in megacities. The rapid migration to big cities and the impossibility of endless expansion of their physical boundaries, necessitate the search for new solutions, both for housing and for accompanying infrastructure. Green areas are no exception, especially since they are among the elements of the urban environment that are standardized in terms of quantity and quality, and from them, to a large extent, we judge the quality of life. All this necessitates a rethinking of established standards and a search for new opportunities to provide the necessary green spaces for every resident.

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1. Introduction.

Industrialization and the rapid development of new technologies are bringing about significant changes in people's lifestyles. Today, many economic sectors are significantly or fully automated, which also leads to the rapid depopulation of small settlements and rapid urbanization. This global trend is set to intensify, with two thirds of the world's population expected to live in megacities by 2050. In Bulgaria, the NSI data (1) from the last census confirm this line even more strongly, with the expectation that in 2030 two thirds of the Bulgarian population will live in four cities: Sofia, Plovdiv, Varna and Burgas.

Unfortunately, cities cannot increase their physical boundaries indefinitely, and overpopulation is already a fact. The construction of new residential and service buildings is at the expense of existing green areas, which in Bulgarian cities, even if they do not fall victim to construction plans, are quickly becoming unregulated car parks or neglected spaces with altered functionality, which we can only call green areas in the provisions of the General Development Plan.

For optimum development in an urban environment, one needs a minimum of 50 square meters of quality green space, which unfortunately is progressively decreasing with the daily increase in urban population.

Currently, 54% of the world's population lives in cities, whereas in the middle of the last century this percentage was only 30 (9). Today in Europe the urban population passes 70%, while in our country it is about 74% (1). In recent years, urbanization has been on the rise at the expense of agricultural, forest and other natural areas (4). Due to the migration of the population to large cities, the number of people employed in the agricultural sector is decreasing and consumption is steadily increasing.

It was this unbridled urbanization that, as early as the beginning of the last century, forced urban planners around the world to think about developing cities vertically, and although at the end of

the century the pace seemed to have slowed down, at the beginning of the present century we are already witnessing a new race and the achievement of increasingly significant height records.

The question before us as professionals is how to deal with them and how to manage their consequences. It is clear to everyone today that cities are some of the most serious heat nuclei and generators of harmful emissions that are dragging the climate into a vicious circle. One way of catching up or slowing down these processes is to increase the quantity and improve the quality of green spaces in the urban environment. Research has focused on the use of vegetation that is resilient to degraded conditions and adapted to the microclimate (21).

Taller buildings and larger numbers of occupants bring with them a number of communication problems, generating traffic requiring wider urban arteries and infrastructure, which are also at the expense of green spaces. And at this point, when we add global climate change, things take on a dramatic character, requiring the search for new sustainable solutions that would solve the problems not palliatively, but generically.

2. Exhibition.

Quite logically, green areas follow the development of the city, and when they do not find a possibility for realization at ground level, they also go in a vertical direction. Roof gardens and vertical landscaping on building facades are not from yesterday, but today they are not just a design fad or whim, but one of the serious options for achieving the optimum amount of green space in an urban environment. A number of countries around the world have already taken action to create a regulatory framework to support the conversion process from traditional green spaces to vertical landscaping in order to increase the ecosystem potential of vegetative volumes in urban environments.

In the context of global climate change, it is green spaces, in the form of vertical and rooftop greening, that provide the opportunity to mitigate and counteract the transformation of cities into heat islands.

Vancouver and Paris (2006-2008) are pioneers in regulating green roofs. Later (2012-2015) they were joined by New York, Berlin, Bonn, etc., and in 2017 the Madrid city government drew up a strategy planning to increase green space in urban areas by 30% by 2050, based entirely on vertical landscaping. In this way they plan to reduce the average, annual temperature amplitude by two degrees, increase the average humidity by 6%, create conditions for local precipitation, and of course significantly reduce noise and dust pollution in the urban environment. All these various effects of vertical greening will synergistically lead to a reduction in heating and ventilation costs of between four and six billion euros, and of course the reduced use of air conditioning will reduce the use of energy sources and the release of harmful emissions into the atmosphere.

The first modern attempts at vertical landscaping were associated with roof gardens as part of so-called green corridors - linked similar elements of the green urban system (22). Later, in the 1990s, the idea of vertical gardens emerged as an alternative to traditional landscaping and part of the green building concept (23). Although 100 years late compared to the first skyscrapers, today there are also the first bold attempts at vertical gardens. After the first vertical park project in New York, which won the EVOLO skyscraper competition in 2010, similar projects have been carried out in every subsequent competition, but more importantly, there are already similar realisations. The first more significant one is:

- ROYAL PARK in Singapore designed by WOHA

Conceived as a mixed-use development with a hotel, office and garden, this project is an example of how a building can not only preserve greenery, but also multiply it in a remarkable way, combined with the principles of sustainable development.



WOHA's designers aim to create a lush rainforest, attractive not only to people but also to birds, that is a natural extension of the green spaces of Hong Lim Park and promotes biodiversity in the city. The building is designed to be a vertical extension of Hong Lim Park and contains 15,000 sqm of intensively landscaped areas.

- Tao Zhu in Taiwan, designed by Vincent Calabrier.

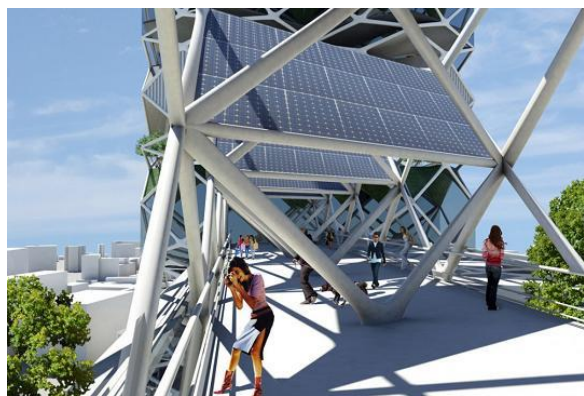
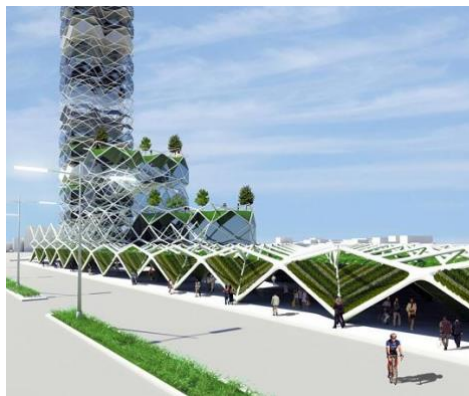
Inspired by the DNA, designed to be energy efficient and carbon absorbing so as to limit emissions and be a tool to combat climate change. The building's facade, roof and terraces will be planted with 23,000 trees and shrubs - almost as many as there are in New York's Central Park.



The skyscraper will absorb 130 tonnes of carbon dioxide per year, equivalent to the emissions of 27 cars over 12 months. This is very important as according to the latest figures Taiwan generates more than 260 million tonnes of carbon emissions per year. The tower represents a pioneering concept of sustainable eco-housing that seeks to limit the ecological footprint of its occupants.

- Stackable Solar Skyscraper in Mexico City, designed by Georges Hernández de la Garza

The Stackable Solar Skyscraper is one of the pioneering vertical park projects without a habitation feature.



-Bosco Vertikale (Vertical Forest) in Milan, 2014, designed by Stefano Boeri (15).

"Vertical Forest is an example of a sustainable residential building with ecological restoration and urban biodiversity. It is a model of vertically sealing nature in the city that operates in the context of reforestation and naturalization policies within the main urban and metropolitan boundaries. The first example of the vertical forest, consisting of two residential towers of 110 and 76 metres high, is located in the center of Milan.



Upon completion of the project, 800 trees (3, 6 or 9 meters), 4,500 shrubs and 15,000 herbaceous and flowering plants will be planted in these areas, distributed according to the exposures and cladding of the individual facades. The vegetation on each of the two towers is equivalent to 20,000 square feet of conventional forest. This vertical forest system contributes to improving the microclimate, increasing humidity, absorbing CO₂ and dust, and producing oxygen. It also helps protect homes from the sun's harmful rays and significantly reduces acoustic pollution. "Vertical forest" increases biodiversity. It helps to create an urban ecosystem in which vegetation creates a vertical environment allowing colonization by birds and insects and therefore becomes a magnet and symbol of the spontaneous rebirth of the city with vegetation and animals. The creation of a number of vertical forests in the city can create a network of ecological corridors, creating the conditions for quantitative and qualitative improvement of the green system.

Of course, many conceptual projects can also be mentioned here, which are getting closer to realization every day.

Bulgaria is no exception, and despite our modest possibilities compared to countries like Italy, Singapore, etc. we also have our projects like Sky Forest, NV Tower, etc.

3. Conclusion.

All these projects look futuristic and are undoubtedly achievements of engineering and design, but much more important in this case is their environmental role in the development of modern cities and the fight against climate change. There is no doubt that today we are on the verge of a revolution in urban planning, and these 'white swallows' will, in the very foreseeable future, radically change the face of cities as we know them, and possibly our way of life.

The new challenges for large architectural offices, besides smart technologies, design and sustainable development principles, are feeding the huge urban population, which could be done through vertical farms combining all the positive aspects of urban landscaping with organic food production in close proximity to humans, utilizing waste materials from human life such as greenhouse gases and compost.

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