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CURRENT ISSUES AND TRENDS IN THE DEVELOPMENT OF GREEN
ARCHITECTURE, URBAN PLANNING AND LANDSCAPE ARCHITECTURE IN
THE CONTEXT OF DIGITAL TRANSFORMATION

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Abstract. *This article examines key issues and promising development directions for green architecture, modern urban planning, and landscape architecture in the context of digitalization and the transition to sustainable development. Key barriers are identified: greenwashing , the high cost of environmental certification, the lack of mandatory standards, climate challenges, the fragmentation of green spaces, and a shortage of specialists. It is shown that geographic information technologies (GIS) are a key tool for integrating architectural, planning, and landscape solutions into a unified bioadaptive system of the urban environment. The research results are applicable to professional practice and educational programs.*

Key words: *green architecture, urban planning, landscape architecture, sustainable development, bioadaptive environment, greenwashing , GIS technologies, ecosystem approach, energy efficiency.*

Annotation . *Maqolada nurse architecture , zamonaviy shahar rejalashtirish va landscape arxitekturasi rivojlanishidagi dolzarb muammolar va istiqbolli yo ' naliqlari raqamlashtirish va barqaror rivojlanishga o ' tish contextida ko ' rib chiqiladi . Asosiy to ' siqlar aniqlandi : grinvoshing , ekologik sertifikatlashtirishning yuqori narxi , majburiy standard yo ' qligi , iqlimiy chaqiriqlar , yashil zonalarining parchalanishi va mutaxassislar tanqisligi . Geoinformatsion texnologiyalar (GIS) arxitektura , rejalashtirish va landscape yechimlarini yagona bioadaptiv tizimga integration qilishning kaliti ekanligi ko ' rsatilgan .*

Kalit so'zlar : *yashil arxitektura , shahar rejalashtirish , landscape arxitektura , barqaror rivojlanish , bioadaptiv muhit , grinvoshing , GIS - texnologiyalari , ekotizimli yondashuv , energiya samaradorligi.*

Abstract. *The article discusses key problems and prospective directions in the development of green architecture, modern urban planning, and landscape architecture in the context of digitalization and the transition to sustainable development. The main barriers are identified: greenwashing, high cost of environmental certification, lack of mandatory standards, climate challenges, fragmentation of green zones, and shortage of specialists. It is shown that geographic information systems (GIS) serve as a key tool for integrating architectural, planning, and landscape solutions into a unified bioadaptive urban environment system.*



Keywords: *green architecture, urban planning, landscape architecture, sustainable development, bioadaptive environment, greenwashing, GIS technologies, ecosystem approach, energy efficiency.*

INTRODUCTION

Modern cities face a complex set of interconnected challenges: accelerated urban population growth, increasing anthropogenic load, climate change, a shortage of high-quality public spaces, and rising energy consumption. According to UN forecasts, by 2050, 68% of the world's population will live in cities, requiring a radical rethinking of approaches to urban design and management.

In these conditions, three interconnected areas are particularly important: green architecture, modern urban planning, and landscape architecture. Each addresses its own challenges—from the energy efficiency of individual buildings to the creation of a city's ecological framework—but their effective integration is impossible without the use of geographic information technologies (GIS), which enable the collection, analysis, and visualization of spatial data at all stages of the design process.

The aim of the study is to identify current problems and promising trends in these areas, as well as to substantiate the role of GIS technologies as an integrating tool for sustainable development of the urban environment.

1. Green architecture: problems and prospects

One of the most pressing problems is greenwashing —the marketing of construction projects as " green " without actually meeting energy efficiency standards. In the CIS countries, less than 1% of new buildings actually meet international environmental standards (LEED , BREEAM , WELL), while the phrase "eco-district" is used ubiquitously in advertising. Obtaining certification for a single building costs the developer a significant amount, revised documentation increases the project cost by 10-30%, and eco-friendly materials are 15-100% more expensive than traditional ones.

The lack of mandatory environmental certification standards in most CIS countries reduces incentives for the adoption of sustainable technologies. A shortage of qualified architects and limited access to certified materials, particularly in the regions, are hindering the industry's development. The green construction market, however, is showing steady growth: from \$538 billion in 2024 to a projected \$959 billion by 2031.

Key trends include the circular economy (using recycled materials and biocomposites , reducing the carbon footprint by 40% by 2040), the introduction of carbon-absorbing materials, and the digitalization of design: BIM technologies, digital twins of buildings and AI platforms for energy audits , which can reduce operating costs by 20–30%.

2. Modern urban planning: challenges and solutions

Urban population growth is overloading transport, utilities, and social infrastructure. In Uzbekistan, the urban population has exceeded 50%, but only 29% of the 8,604 settlements are covered by general plans, and 275 master plans developed are not linked to these general plans. Housing affordability remains a pressing issue, and the "urban heat island" effect is



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particularly acute in Uzbekistan's arid zone: in densely populated areas, temperatures can be 6° C higher than in green areas. Key trends include: a human-centered approach (priority for pedestrians and public transport, multifunctional neighborhoods); digitalization and AI (digital twins of cities, IoT sensors, predictive analytics); citizen participation in design through digital platforms; and new financing mechanisms (escrow accounts, national urban quality projects).

3. Landscape architecture: current issues

Densification and intensive urbanization are reducing the area of green spaces: the standard of at least 16 m² per person is often not met. The fragmentation of green spaces hinders the formation of a unified ecological framework for the city, which is especially acute in arid regions. The increasing frequency of extreme weather events requires new drainage strategies, the selection of drought-resistant vegetation, and microclimate management. Design errors—inappropriate plant selection, ignoring soil properties, and the absence of a maintenance plan—reduce the effectiveness of landscape solutions. Current trends include the integration of architecture into the landscape (bionic forms, geoplastics), vertical gardens and green roofs with hydroponic systems, smart irrigation systems based on IoT sensors, innovative materials (CLT timber, biocomposites, Corten steel), and an ecosystem approach: rainwater harvesting, natural filtration, and green corridors for biodiversity conservation.

4. The role of GIS technologies in the integration of directions

Geoinformation technologies (GIS) serve as a link between green architecture, urban planning, and landscape architecture. In green architecture, GIS is used to analyze insolation, wind flow, and energy audits. In urban planning, it is used to model development scenarios, analyze transport accessibility, and designate zones. In landscape architecture, it is used for mapping green spaces, analyzing soils, hydrology, and monitoring biodiversity. GIS enables the creation of digital twins of territories, combining data on topography, vegetation, hydrology, transport networks, and development. This makes it possible to model microclimatic conditions (heat islands, wind corridors), analyze the accessibility of public spaces, calculate the carbon footprint at the neighborhood and city levels, and engage citizens in the planning process through interactive mapping interfaces. For the arid regions of Uzbekistan, the use of GIS is particularly important: modeling drought adaptation scenarios, optimizing irrigation systems, and creating green corridors that take water resources into account.

Conclusion

Green architecture, modern urban planning, and landscape architecture are interdependent fields whose coordinated development determines the quality of the urban environment and the sustainability of cities. Despite existing challenges (greenwashing, a lack of standards, high implementation costs, and climate change), modern trends—digitalization, the circular economy, an ecosystem approach, and the use of GIS technologies—open fundamentally new opportunities for creating sustainable and adaptive cities. For Uzbekistan, located in an arid zone and experiencing a period of intensive

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urbanization, integrating these fields with GIS is an imperative. Further research should focus on developing methods for integrating GIS into architectural planning, adapting international experience to regional conditions, and training a new generation of specialists proficient in green engineering tools.

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