

Available vertical farming options are container-type greenhouses units that implement modular systems. The most convenient aspect of them all relates to their size as well as their ability to be moved around. They can be installed quickly and with minimal resources into any city type of infrastructure. They are very self-sustaining structures, which allows these modules to be installed within small spaces or even secured zones [1]; this is a very critical factor in today's environment.

Full-scale War In Ukraine Has Caused Many Crop Production Losses In Its Agriculture Sector [4]. It Has Also Caused Cropland To Decrease And Fresh Vegetables To Be Difficult To Supply. Under These Conditions; Vertical Farms as well as Urban Farming can help ensure Food Security. As an example of this, a vertical farm exists within a bomb shelter in Dnipro. The farm produces mainly green crops (Lettuce, Arugula, Mustard, Spinach, etc.) [3]. Through various trials on this farm, the amount of green products available for sale in Ukraine has doubled because of the vertical farming process. This case does show that with less than conventional land access, vegetables can be grown even under extreme limits of cultivation.

Thus, modular vertical farming systems could be a step into the future in the agronomic and food sectors. They could become a tool for increasing the resilience of food systems in crisis conditions, not only in Ukraine but also worldwide.

References:

1. Vertical farming. URL: <https://www.britannica.com/topic/vertical-farming>. Мова англ. (Дата звернення: 21.02.2026);

2. URBAN FARMING. The Advancement of Vertical Farming Systems. URL: <https://viemose-dgs.dk/vertical-farming-urban-farming/>. Мова англ. (Дата звернення: 21.02.2026);

3. Стаття: "Одну з найбільших вертикальних ферм в Україні створено в бомбосховищі в Дніпрі». URL: <https://superagronom.com/news/18610-odnu-z-naybilshih-vertikalnih-ferm-v-ukrayini-stvoreno-v-bomboshovischi-u-dnipro>. Мова укр. (Дата звернення: 21.02.2026);

4. Organic agriculture in Ukraine shows more resilience in crisis situations than conventional. URL: <https://organicinitiative.org.ua/en/news/organic-agriculture-more-resilience/#:~:text=News-.Organic%20agriculture%20in%20Ukraine%20shows%20more%20resilience%20in%20crisis%20situations,supply%20chains%20in%20conventional%20farming>. Мова англ. (Дата звернення: 21.02.2026).

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COMPUTATIONAL APPROACHES TO OPTIMIZING REGIONAL PLANNING

Досліджено стратегічне значення та кар'єрні можливості здобуття ІТ-освіти в галузевих аграрних закладах вищої освіти. Розглянуто вплив новітніх цифрових рішень, систем штучного інтелекту та інженерії програмного забезпечення на процеси модернізації сільського господарства (AgriTech).

Ключові слова: ІТ-освіта, цифровізація сільського господарства, AgriTech, інтелектуальні системи, програмна інженерія, аграрний ЗВО.

The strategic importance and career opportunities of acquiring IT education within specialized agrarian higher education institutions are investigated. The impact of cutting-edge digital solutions, artificial intelligence systems, and software engineering on the modernization of agriculture (AgriTech) is examined.

Keywords: IT education, agricultural digitalization, AgriTech, intelligent systems, software engineering, agrarian HEI.

The landscape of urban and regional development is currently facing unprecedented challenges driven by economic fluctuations, rapid urbanization, and strict ecological constraints. Historically, spatial planners relied on traditional, often heuristic methods, which are increasingly inadequate for navigating today's multifaceted environments. Such outdated approaches frequently lead to resource mismanagement and a disconnect between infrastructural growth and actual public needs. Consequently, computational optimization algorithms have emerged as a critical tool for generating evidence-based, highly efficient territorial development strategies.

Deploying algorithmic models allows experts to resolve complex, multi-objective spatial problems. These computational systems excel at determining the ideal configurations for residential, industrial, and recreational zones while balancing socioeconomic demands with environmental preservation. By simulating various land-allocation scenarios, algorithms can forecast long-term ecological and economic impacts, enabling stakeholders to select the most advantageous pathways. Recent analyses of Ukrainian urban infrastructure highlight that computational optimization significantly streamlines public transit networks and zoning layouts, ultimately driving down municipal costs and maximizing spatial utility [3].

A primary advantage of utilizing these algorithms is their capacity for predictive modeling. Planners can input variables to simulate the cascading effects of new infrastructural projects – such as constructing highways, medical facilities, or public parks – before any physical work begins. This shifts the paradigm from intuition-based planning to rigorous, data-driven governance, fostering resilient urban growth. For instance, Ukraine's updated General Scheme of Spatial Planning emphasizes a structurally optimized approach to zoning that harmonizes societal needs with economic realities [2].

Furthermore, computational optimization plays a vital role in ecological sustainability. Algorithms can automatically filter out environmentally sensitive areas, such as water reserves and protected green spaces, recommending construction only on optimal plots. This guarantees that economic expansion does not come at the expense of environmental degradation [5].

From a financial perspective, algorithmic planning maximizes the efficiency of limited assets, including land, water, and municipal budgets. By minimizing long-term maintenance and infrastructure costs, these tools deliver outsized benefits to the public. This computational efficiency is especially crucial for rural areas and mid-sized municipalities operating under strict financial constraints [4].

In addition to technical benefits, optimization models democratize the planning process. Because algorithmic outputs are quantifiable and objective, proposed development scenarios can be transparently presented to local communities and governmental bodies. This open approach mitigates social conflicts, builds public trust, and encourages productive collaboration among investors, citizens, and policymakers [6].

Despite their robust capabilities, it is important to acknowledge the limitations of these systems. Optimization algorithms are highly dependent on the quality and granularity of input data. Moreover, processing vast geographical datasets requires significant computational power and time. Therefore, these algorithms should function as powerful decision-support systems rather than autonomous decision-makers, requiring skilled IT and planning professionals to accurately interpret their outputs.

Ultimately, integrating computational optimization into spatial planning represents a paradigm shift in regional governance. By ensuring that budget allocations and infrastructural investments are mathematically justified, these algorithms facilitate more equitable, sustainable, and transparent urban development. Expanding the use of such advanced computational tools is essential for modernizing territorial policies and elevating the overall quality of life.

References:

1. State Institution "Institute of Regional Research of the NAS of Ukraine". Economic and spatial aspects of territorial development. [in Ukrainian]. URL: http://jnas.nbu.gov.ua/jpdf/EkUk_2021_11_4.pdf (Accessed: February 24, 2026)

2. Palekha, Yu. M. (2020). New edition of the General Scheme of spatial planning of the territory of Ukraine. *Ukrainian Geographical Journal*. [in Ukrainian]. URL: https://ukrgeojournal.org.ua/sites/default/files/UGJ-2020-1_07-15.pdf (Accessed: February 24, 2026)

3. Bilichenko, V. V., et al. (2021). Optimization of the public transport network (on the example of Cherkasy city). [in Ukrainian]. URL: <https://vmt.vntu.edu.ua/index.php/vmt/article/view/234/211> (Accessed: February 24, 2026)

4. Senkiv, M. I. (2016). Transport and distribution geologistics in the Western region of Ukraine. [in Ukrainian]. URL: https://lnu.edu.ua/wp-content/uploads/2017/05/aref_senkiv.pdf (Accessed: February 24, 2026)

5. Shterndok, Ye. S. (2022). Planning and effective use of territories. [in Ukrainian]. URL: <https://eprints.kname.edu.ua/63558/1/2022%20209%D0%9B%20%D0%A8%D1%82%D0%B5%D1%80%D0%BD%D0%B4%D0%BE%D0%BA.pdf> (Accessed: February 24, 2026)

6. Lysiak, N. M., Khabrel, M. M., & Khromiak, Yo. Ya. (2022). The scheme of planning the territory of the region as a strategic basis for substantiating the concept of integrated development of the territorial community. [in Ukrainian]. URL: https://re.gov.ua/re202203/re202203_024_LysyakNM%20KhabrelMM%20KhromyakYoYa.pdf (Accessed: February 24, 2026)

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IMPLEMENTATION OF DIGITAL MARKETING TECHNOLOGIES IN THE AGRICULTURAL SECTOR OF UKRAINE

Розглянуто значення цифрових технологій для розвитку аграрного сектору України. Розкрито основні проблеми цифровізації, серед яких низька цифрова грамотність, слабка інфраструктура та відсутність корпоративних стратегій. Відзначається, що саме розвиток цифрового маркетингу сприятиме підвищенню конкурентоспроможності агропідприємств і їх інтеграції у глобальну цифрову економіку.

Ключові слова: цифрові інструменти, маркетинг, діджиталізація, хмарні технології, цифровізація, цифрова трансформація

The significance of digital technologies for the development of Ukraine's agricultural sector is considered. The main problems of digitalization are revealed, including low digital literacy, weak infrastructure, and the lack of corporate strategies. It is noted that the development of digital marketing will contribute to increasing the competitiveness of agricultural enterprises and their integration into the global digital economy.

Keywords: digital tools, marketing, digitalization, cloud technologies, digitization, digital transformation.

Technological transformations of the 21st century have become a catalyst for the rapid development of digital technologies and the formation of a digital economy based on the extensive use of data. This contributes to increasing the efficiency of enterprises, particularly in the real sector of Ukraine's economy, and positively affects the standard and quality of life of the population. At the same time, the agricultural sector, due to its specific features, has a particular need for the implementation of modern digital solutions. The performance of agricultural production largely depends on natural resource and climatic potential, rational land use, the seasonal nature of activities, the spatial location of farms, as well as technological, technical, social factors and the level of state support.

Despite the significant human and intellectual potential for the development of digital marketing, the level of digitalization in Ukraine's agricultural sector remains low. As a result, the