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«Science and innovations in the 21st century»

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У збірнику представлені матеріали IV Всеукраїнської Інтернет-конференції студентів та молодих вчених за результатами досліджень у галузі природничих наук, механічної інженерії, електричної інженерії, виробництва та технологій, архітектури та будівництва, аграрних наук та продовольства, управління та адміністрування, сфери обслуговування, інформаційних технологій, цивільної безпеки, соціальних та поведінкових наук, гуманітарних наук.

Матеріали призначені для наукових співробітників, викладачів, магістрантів, студентів й аспірантів вищих навчальних закладів, фахівців і керівників підприємств різної організаційно-правової форми, працівників державного управління, освіти та місцевого самоврядування.

Відповідальність за зміст наданих матеріалів, точність наведених даних та відповідність принципам академічної доброчесності несуть автори.

Подані на конференцію матеріали видаються в авторській редакції.

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Природничі науки: інноваційні підходи та дослідження

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INCREASING THE CRACK RESISTANCE OF ROCKS TO ENSURE THE SAFE OPERATION OF STRUCTURES

Hardening rocks around the foundations of buildings and buried structures helps reduce the likelihood of cracks, prevent the spread of deformation and increase the overall resistance of construction objects to the impact of operational and natural loads. At the same time, the requirements for the durability and operational safety of infrastructure and industrial structures are constantly increasing.

Rock hardening is a technology of filling voids, pores and cracks with special compounds capable of solidification. As a result of the solution polymerization, a strong framework is formed, increasing the strength and water resistance of the rocks, which helps to reduce rock deformation and improves hydrogeological conditions. The parameters of hardening are the physical and mechanical characteristics of the rocks after the hardening technology is applied (depending on the selected hardening method), as well as the shape, size and localization of the hardened zones relative to the contour of the structure. The main characteristics that determine the effectiveness of hardening are the achieved strength and the increase in the bearing capacity of the rocks, which directly affect the stability of the structure.

The analysis of the features of rock deformation and the engineering structures stability loss showed that traditional support systems do not always provide the required level of stability, especially in conditions of high rock fracturing. Therefore, to solve the problem of underground structures stability, mathematical modeling was performed using the finite element method for conditions of uneven loads on the support.

The calculations were performed using the GEO-RS© software package [1]. Software package is different from the known ones by the ability to determine the geometric and energy parameters of rock destruction zones (length, volume, potential energy, deformation intensity, kinetics of micro- and macro-destruction zones), systems of man-made main cracks, and high accuracy of the results. The research methodology is presented in [2].

The hardening zones were represented by elliptical sectors (Fig. 1). Changing the shape of the hardened zone leads to a redistribution of the stress and strain field, with the bearing pressure shifting slightly toward the vertical axis of the working. It has been established that for conditions of uneven loads on the support of buried structures, an asymmetric shape of the hardened zone can be used as a reserve for increasing stability. The elliptical shape of the hardened zone, as an element of rock pressure control, ensures an increase in the stability of the underground structure by reducing the inelastic deformation zone by 10-35% and shifting the asymmetric support pressure zone into the rock by 0.5-3 m. With an elliptical hardening zone, the displacements of the working roof are reduced by 6-13% of the total displacements, and the working floor - up to 25%.

Hardening zones in the form of ellipsoid or asymmetric shapes help to ensure that stresses are redistributed evenly and do not create local maxima near the sides of the working. This reduces the risk of failures caused by stress concentrations in local zones adjacent to corners and junctions of buried structures. For example, ellipsoidal hardening zones help to effectively move the area of high stresses to more remote parts of the massif, where their energy is absorbed without significant consequences for the stability of the working.

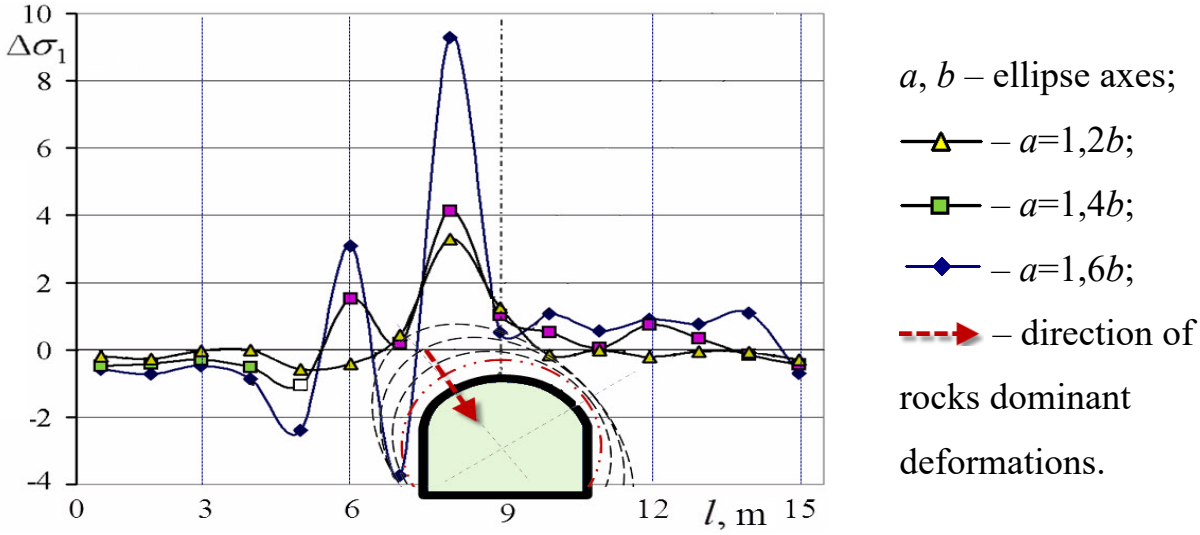

Figure 1. Changes in maximum principal stresses when using different elliptical shapes of hardened zones (stresses $\Delta\sigma_1$ are shown in MPa).

Conclusions. Thus, hardening of rocks by means of injection and other hardening technologies allows to effectively compensate disadvantages of supports without a significant increase in capital expenditures. In addition, the use of various configurations and arrangement schemes of hardening zones allows flexible adaptation to specific mining and geological conditions, redistribution of stresses in rocks, reduction of their concentrations in potentially dangerous zones, prevention of local collapses and deformations, and also ensuring long-term safe use of underground structures.

REFERENCES

1. Zhihang Ye., Kevin G., Halil S., Gang W., De-Cheng F. (2021), State-of-the-art review and investigation of structural stability in multi-story modular buildings, Journal of Building Engineering, Vol. 33, pp. 101844. https://doi.org/10.1016/j.jobe.2020.101844

2. Bulat, A.F., Slashchov, I.N. & Slashchova O.A. (2017), Evaluation methods of interconnected geomechanical and gas dynamic processes in the rock massif for the systems of working medium control in the mines, Geoteh. meh., no. 134, pp. 3-21. https://doi.org/10.15407/geotm2017.134.003

3. Ikonnikov M.YU., Ikonnikov YU.R., Slashcheva Ye.A., Slashchov I.N. & Yalanskiy A. (2015) Mathematical modeling in solving problems of evaluating the efficacy and safety of mining operations, NGU and IGTM NAS of Ukraine, 215 pages, Dnipropetrovsk, UA. ISBN: 978-966-350-532-9 http://ir.nmu.org.ua/handle/123456789/146561

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BIOMASS AND WOOD AS AN ECOLOGICALLY CLEAN FUEL

Modern world is faced with an urgent need to reduce greenhouse gas emissions and find alternative energy sources. One of these solutions is the use of biomass, in particular, wood as a renewable source of thermal energy. Wood is a traditional fuel that is widely used in private households, especially in the conditions of rising prices for fossil fuels [1].

One of the main advantages of wood fuel is its relative price stability compared to gas or oil. In addition, wood has a largely CO_2 neutral balance, because during its combustion process, the amount of carbon dioxide is equal to the amount the plant absorbs during growth. This makes it an environmentally friendly source of energy, which contributes to the reduction of the overall level of greenhouse gases in the atmosphere [7].

Wood fuel is divided into several main types: firewood, wood chips and pellets. Each of these types has its own characteristics and areas of application. Firewood is traditionally used in stoves and fireplaces, while chips and pellets are popular among owners of automated boilers, which provide convenience and efficiency of heating

Studies show that CO_2 emissions from burning natural gas exceed the corresponding figures of wood by 14 times, oil by 18 times, and coal by 26 times. This means that switching to biomass can significantly reduce the negative impact on the environment [1].

One of the important factors in the efficiency of wood fuel is its moisture content. The lower the water content in wood, the higher its calorific value. Dry wood burns

more efficiently and provides more heat with less material consumption. The calorific value of 1 kg of dry wood is equivalent to 2.5 kg of raw wood. This means that proper storage and preparation of wood fuel can reduce its consumption by almost half. The size and shape of wood fuel also matter. Firewood, wood chips and pellets have different densities, which affect combustion efficiency. It is recommended to use firewood 50 cm long and 8 cm thick for the best calorific value [8].

Modern biofuel combustion technologies are allowed for the most efficient use of wood and pellets energy. Examples of modern wood and biofuel combustion technologies were taken from boilers manufactured by the Austrian company HERZ. Grate combustion is a classic method where fuel burns on a special grate. There are several options:

1. Bottom feed, when fuel is fed from below, which ensures even combustion;

2. Pushing grate allows fuel to be moved automatically, increasing efficiency;

3. Vibrating grate is self-cleaning grate, which makes maintenance easier [3];

4. Blown combustion uses forced air supply, which makes the process more intense. Cyclone burner creates a vortex that ensures complete combustion. Tunnel kiln distributes heat evenly [4];

5. Fluidized bed is an innovative technology where fuel is suspended in the air stream and it ensures almost complete combustion and minimal emissions;

6. Wood-fired boilers operate on the principle of bottom combustion: the fuel smolders and the gases released provide additional heat. It makes the process more efficient and long term [5];

7. Tilting grate automatically cleans and supplies air optimally, therefore ensuring good combustion and minimal maintenance;

8. Step and piston beater is a moving grate which creates an even fire and it increases efficiency and allows to use up fuel completely [6].

Biofuel is a renewable energy source. The combustion process has CO_2 neutrality. We do not depend on imported gas or oil.

Rising fossil fuel prices make wood more competitive. Since 2010, gas and wood prices have increased by about 5%, while the cost of oil has increased by 28%. The cheapest energy source remains wood chips, which cost about 2.55 cents per kWh [2].

Summing up the above mentioned information we come to the conclusion that the use of wood as an energy source has significant environmental and economic benefits. Its CO_2 neutrality, high energy efficiency and availability make wood fuel an important component in the strategy for the transition to renewable energy sources. Current environmental challenges and economic trends, the popularity of wood fuel will continue to grow, contributing to sustainable development and reducing climate impact.

REFERENCES

1. Деревні пелети – екологічно чисте тепло. *Solid Teploenergo*. 29.10.2019. URL: http://solid-teploenergo.com.ua/derevni-peleti-ekologichno-chiste-teplo/ (дата звернення: 12.03.2025).

2. Друкований М., Максименко Ю. ДЕРЕВИНА – САМИЙ ДЕШЕВИЙ ВИД ПАЛИВА. *ЗБІРНИК НАУКОВИХ ПРАЦЬ. УДК 621.317.385:662.17*. URL: http://repository.vsau.org/getfile.php/3544.pdf (дата звернення: 12.03.2025).

3. Котли HERZ на дровах, пелетах та деревній тріщі для приватного домогосподарства. *HERZ*. URL: https://herz.ua/blog/category/nova-produkcziya/kotly-herz-na-drovah-peletah-ta-derevnij-trisczi-dlya-pryvatnogo-domogospodarstva-2/.

4. Wood gasification boiler firestar 18-40 kW De Luxe series. *HERZ*. URL: https://www.herz-energie.at/en/products/boiler-for-log-wood/herz-firestar-gasification-boiler-18-40/.

5. Pellet boiler pelletstar 10-60 T-Control. *HERZ*. URL: https://www.herz-energie.at/en/products/herz-pelletstar-10-60-t-control/.

6. Wood chip-/ pellet boiler firematic 80-301 kW. *HERZ*. URL: https://www.herz-energie.at/en/products/wood-chip-pellet-boiler/herz-firematic-80-301/.

7. Переваги і недоліки деревини. *Drevesina Blogspot*. URL: https://drevesina10.blogspot.com/p/blog-page_9.html.

8. Характеристика та особливості дров як палива. *Biowatt*. URL: http://www.biowatt.com.ua/informatsiya/harakteristika-ta-osoblivosti-drov-yak-paliva/.

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MARINE DRONE TECHNOLOGY FOR OCEAN WASTE MANAGEMENT

Plastic pollution has become one of the most pressing environmental challenges of the 21st century. Every year, almost 12 million tons of plastic waste enters seas and oceans, which were created solely by humans and therefore only humans are responsible for this pollution. There is an estimated 75 to 199 million tons of plastic waste currently in our oceans, with a further 33 billion pounds of plastic entering the marine environment every single year. As plastic continues to accumulate, it poses an escalating threat to marine ecosystems, biodiversity, and ultimately, human health. Addressing this issue requires a comprehensive understanding of its scale, sources, and potential solutions [1].

One of the companies that is engaged in cleaning up the world's oceans is The Ocean Cleanup. This nonprofit organization utilizes advanced technologies to remove plastics from both the ocean surface and river systems. As of now, they have successfully removed over 22.7 million kilograms of marine debris, with more than 550,000 kilograms collected in the last 30 days alone. Their work represents a significant step forward in mitigating the impacts of plastic pollution [3].

In addition, marine drones, also known as Unmanned Surface Vessels (USVs), are projected to offer a more efficient approach to oceanic waste management. A single mothership, equipped with a crane, can transport six or more small Unmanned Surface Vessels (USVs) ranging from 10 to 20 meters in length, along with several conventional manned vessels. The mothership serves multiple roles, including transoceanic transportation to and from the designated cleanup zones, on-site maintenance and repair operations, and temporary storage during adverse weather

conditions. The USVs are powered by electric motors to enhance environmental sustainability and optimize energy efficiency, as electrical energy generation at sea is more feasible and less polluting than the use of fossil fuels. A portion of the electrical power will be supplied by onboard solar panels mounted on the USVs [2].

Additionally, the implementation of modular, quick-swap battery systems will minimize downtime during energy replenishment, allowing for only brief interruptions in the waste collection process. Positioning the mothership centrally enhances coordination with surrounding USVs. Support vessels will handle tasks such as refueling, equipment deployment, and interaction with marine life. Both the mothership and these vessels will control the USVs remotely. One USV may serve as a reconnaissance unit, equipped with integrated or tethered sonar systems—via buoys or underwater drones—for locating and analyzing marine debris. Using USVs in this way they can make the process of collecting ocean and marine garbage faster, more environmentally friendly and cost-effective [4, 5].

In conclusion, tackling the global plastic pollution crisis demands not only increased awareness and international cooperation but also the integration of advanced technological solutions. The use of marine drones (USVs), supported by a strategically deployed mothership and auxiliary vessels, represents a promising and scalable approach to oceanic waste collection.

REFERENCES

1. RTS - Recycle Track Systems. (2025, January 10). *Plastic Pollution in the Ocean - 2025 Facts and Statistics.* Recycle Track Systems. https://www.rts.com/blog/plastic-pollution-in-the-ocean-facts-and-statistics/

2. *Plastic pollution: facts & figures - Surfers Against Sewage*. (n.d.). Surfers Against Sewage. https://www.sas.org.uk/plastic-pollution/plastic-pollution-facts-figures/

3. The Ocean Cleanup. (n.d.) https://theoceancleanup.com

4. The Ocean Cleanup. (2025, April 29). *Dashboard | The Ocean Cleanup* . https://theoceancleanup.com/dashboard/

5. Top 25 recycling facts and statistics for 2022. (2022, June 10). *World Economic Forum*. https://www.weforum.org/stories/2022/06/recycling-global-statistics-facts-plastic-paper/

Механічна інженерія: сучасні тренди та технологічні прориви

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ANALYTICAL AND NUMERICAL ANALYSIS OF DEFORMED STATE OF RECTANGULAR PLATES UNDER DIFFERENT TRANSVERSE LOADS

Structural elements in the form of plates and shells are widely used in construction, aircraft, mechanical engineering, and other industries. Calculations of such elements for strength, stiffness and stability are important from both theoretical and practical points of view. Various theories can be used for this purpose: the classical ones based on the Kirchhoff-Love hypotheses, the refined ones based on certain physical and geometric hypotheses, as well as the theories based on a strictly mathematical approach, according to which the components of the stress-strain state and boundary conditions on the lateral surface develop into infinite mathematical series along the transverse coordinate [1, 2, 3]. At the same time, the three-dimensional problem of elasticity theory is reduced to a two-dimensional one by various methods, including variational methods. Research shows that the classical theory gives underestimated results for the components of the stress-strain state [1, 2, 3]. However, for a certain class of problems, the results of the classical theory have a certain benchmark for refined engineering calculations.

The paper deals with the deformed state of homogeneous isotropic rectangular plates ($x \in [0;a]$, $y \in [0;b]$, $z \in [-h/2;h/2]$, where a,b – dimentions of the plate in plan, h – thickness) freely supported at the edges under the action of concentrated forces F and uniformly distributed local loads $q(x,y)=q_0$, acting on rectangular planes located anywhere in the plate region. The task is to approximate the deflection of the plate in the center through the position of the center of the load plane (or the point of application of the concentrated force).

Here are the basic equations. Differential equation of equilibrium [4]:

$$\frac{\partial^4 w(x,y)}{\partial x^4} + 2\frac{\partial^4 w(x,y)}{\partial x^2 \partial y^2} + \frac{\partial^4 w(x,y)}{\partial y^4} = \frac{q(x,y)}{D} \tag{1}$$

Where $D = Eh^3 / (12(1-v^2))$ – the cylindrical stiffness, E, v – is the mechanical constants of the material, h – the thickness of the plate, and $q(x,y)$– the transverse load, which is represented by a continuous or discontinuous function that, after certain mathematical calculations, can be represented as follows:

$$q(x,y) = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} q_{mn} \cdot sin\left(\frac{m \cdot \pi \cdot x}{a}\right) \cdot sin\left(\frac{n \cdot \pi \cdot y}{b}\right) \tag{2}$$

where for the local load q_0

$$q_{mn} = \frac{16 q_0}{ab\alpha_m \beta_n} sin(\alpha_m c) sin(\beta_n d) sin(\alpha_m \xi) sin(\beta_n \eta) \tag{3}$$

$$\alpha_m = m\pi / a,\ \beta_n = n\pi / b;$$

(c,d) – coordinates of the center of a rectangular plane of local load (or point of application of a concentrated force) with dimensions $x \in [c-\xi; c+\xi]$, $y \in [d-\eta; d+\eta]$.

The concentrated force F acts at point (c,d) and it can be represented as a series (2), where the coefficients q_{mn} are determined based on (3), if we move to the limit, assuming that $\xi \to 0,\ \eta \to 0,\ q_0 \cdot 2\xi \cdot 2\eta \to F$.

We will get: $q_{mn} = 4F \cdot sin(\alpha_m \cdot c) \cdot sin(\beta_n \cdot d) / (ab)$.

Then the function $q(x,y)$ will take the form:

$$q(x,y) = \frac{4F}{ab} \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} sin(\alpha_m \cdot c) sin(\beta_n \cdot d) sin\left(\frac{m \cdot \pi \cdot x}{a}\right) sin\left(\frac{n \cdot \pi \cdot y}{b}\right).$$

The solution to the differential equation (1) is obtained as follows:

$$w(x,y) = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} w_{mn}\, sin\left(\frac{m \cdot \pi \cdot x}{a}\right) sin\left(\frac{n \cdot \pi \cdot y}{b}\right) \tag{4}$$

where the coefficients w_{mn} are expressed in terms of q_{mn}, given (1) – (3).

As a result, taking into account this (4), we obtain the deflection function:

$$w(x,y)=\frac{1}{D}\sum_{m=1}^{\infty}\sum_{n=1}^{\infty}\frac{q_{mn}}{\left((m\cdot\pi/a)^2+(n\cdot\pi/b)^2\right)^2}sin\left(\frac{m\cdot\pi\cdot x}{a}\right)sin\left(\frac{n\cdot\pi\cdot y}{b}\right).$$

Quite a large number of numerical results were obtained for the deflection in the center of the plate, depending on the size of the rectangular loading plane and the position of its center (the point of application of the concentrated force). The equivalent load *R* across the load plane and the concentrated force *F* were assumed to be equal.

An in-depth analysis of the results was carried out, on the basis of which the deflection value in the center of the plate was approximated depending on the position of the load center. The deflection in the center of the plate was found analytically in the form of polynomials of the 4th degree from the distance of the load center to the center of the plate, and the coefficients in these dependencies, in turn, were approximated by the angle φ, which was the angle between the radius vector (center of the plate *O* - center of the load O_i) and the *Ox* axis. The approximated dependencies are qualitatively as follows (where *R* – equivalent load):

$$W(x)=R\cdot\left(a_4(\varphi)\cdot x^4+a_3(\varphi)\cdot x^3+a_2(\varphi)\cdot x^2+a_1(\varphi)\cdot x+a_0(\varphi)\right),\ x=OO_i,$$

REFERENCES

1. Зеленський, А. Г. (2009). Моделі аналітичної теорії трансверсально-ізотропних плит. *Вісник Дніпропетр. ун-ту*. Дн-вськ, Т. 17, 5. Серія механіка. В. 13, т. 2. 54–62.

2. Зеленський, А. Г. (2011). Моделі і методи аналітичної теорії нетонких пластин та пологих оболонок при статичному навантаженні. *Вісник Придніпр. держ. академії будівництва та архітектури*. Зб. наук. праць. Дн-вськ: ПДАБА, 1–2. 21–30.

3. Немиш, Ю. Н., Хома И. Ю. (1993). Напряженно-деформированное состояние нетонких оболочек и пластин. Обобщенная теория (Обзор). *Прикл. механика*. 29, 11. 3–32.

4. Тимошенко, С. П., Войновский-Кригер, С. (1963). Пластины и оболочки М.: Физматиз.

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THE IMPORTANCE OF MECHANICAL VENTILATION

To begin with, mechanical ventilation plays a critical role in maintaining indoor air quality, particularly in environments where natural airflow is insufficient. With growing concerns about air pollution, energy efficiency, and airborne diseases, the need for reliable and effective ventilation systems has become more pressing than ever. Mechanical systems ensure a controlled and consistent exchange of indoor and outdoor air, thereby protecting human health and contributing to overall building performance. In addition, they are essential for meeting modern standards in occupational safety, thermal comfort, and environmental sustainability.

It should be noted that, ventilation is a system that provides fresh air from the street and removes polluted (exhaust) air from the room, providing comfortable climatic and necessary sanitary conditions for the room, depending on its purpose.

The following classifications of ventilation systems can be distinguished based on their operational principles and functional characteristics:

1) Behind the principle of action:

- Natural - is carried out due to the pressure difference between the outside and inside of the room;
- Mechanical - is carried out due to the difference in pressure created by fans;

2) By purpose:

- supply - system supplying fresh air from the environment into the room;
- exhaust - system removing exhaust air from the room;

- supply and exhaust - combines the two previous systems but can be supplemented with a recuperation system for heat intake from the exhaust air and heating of the supply air in order to save energy costs for heating the supply air;
- emergency - a type of exhaust ventilation that is installed in rooms where it is necessary to remove a large amount of contaminated air from the room in emergencies;
- local - exhaust or supply and exhaust system, which is arranged “point by point” in places of increased concentration of harmful substances and is designed to rapidly remove contaminated air to prevent the spread of dangerous substances in the entire room.

Furthermore, natural ventilation has advantages over mechanical ventilation in terms of price. There is no need to install expensive mechanical units. Natural ventilation is autonomous compared to mechanical ventilation, as its operation does not require electricity. The disadvantages include the difficulty of regulating the flow of air through this system and the lack of control of microclimatic air parameters such as temperature, humidity, dust levels, etc.

Mechanical ventilation depends on the power grid as the mechanical equipment requires power from it. Still, this system provides the possibility of accurate regulation of air exchange due to the control of the flow of supply air blown by the fan and has an extensive range of modifications such as heaters, filters, humidifiers, and air ionizers, which provide the possibility of very flexible and accurate control of sanitary and hygienic air parameters. The disadvantages are the equipment is bulky and relatively high noise level, which requires the arrangement of a separate technical room for the location of this equipment, as well as the organization of vibration-noise-attenuating measures in the design and installation.

A study of the energy efficiency of modern ventilation systems determined that modern supply and exhaust ventilation systems can retain up to 90% of the heat or cold in summer that would typically be lost with exhaust air from an exhaust ventilation system. These systems can save up to 60% of the energy used for heating in winter and

up to 40% for cooling the supply air in summer. Modern cleaning filters for mechanical ventilation systems can remove up to 98% of contaminants in the supply air, which provides a high level of air purity and ensures the proper level of sanitary and hygienic indicators in critical rooms such as operating rooms, and duct heaters, humidifiers or dehumidifiers set ideal air parameters for rooms for any purpose, which makes such systems indispensable for buildings with high standards of air quality and microclimate.

In conclusion, modern supply and exhaust ventilation systems are diverse and have a wide range of applications. Due to its flexibility and accuracy in the selection of the system, it can not only provide the necessary microclimatic conditions but also minimize the economic costs of buildings and structures by reducing the consumption of energy resources. In turn, these measures lead to a reduction of environmental pollution from the building itself, reducing the emission of heat into the environment, and reducing the damage to the planet from the production of energy resources.

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INTENSIFICATION OF WASTEWATER TREATMENT BY ELECTRICAL TECHNOLOGIES

One of the key challenges in managing water supply in industry is wastewater treatment. The discharge of industrial wastewater into water bodies can cause pollution, leading to serious environmental and health consequences. To address this

problem, industries are implementing various wastewater treatment technologies, including physical, chemical and biological treatment methods. Since most mechanical impurities tend to have magnetic properties, there is a real prospect of using electrical technology methods for wastewater treatment. Thus, the intensification of wastewater treatment using electrical technologies, improvement of technologies and technical means of mechanical impurities removal becomes a very urgent task, as it is a significant reserve for improving technological processes.

Wastewater consists of water and particles that typically come from feces, food waste, chemicals from personal care products, cleaning products, cosmetics and medicines, and other products. These solids or particles are either dissolved, suspended or floating in the wastewater. During the treatment process, they are separated or filtered out as sludge [1,2,3].

Industrial plants also generate significant volumes of wastewater that contain chemicals or contents specific to their production process. The largest polluters of surface and groundwater are electricity - 43%; utilities - 19.5%; agriculture - 16.6%; ferrous metallurgy - 9%; chemicals and petrochemicals - 3%; other - 8.9%.

The main purpose of wastewater treatment is to protect the environment from the adverse effects of wastewater discharge and to ensure the required quality of both surface and groundwater. However, increasing requirements for water treatment quality require the intensification of existing treatment facilities or the design of new ones.

The modernization is carried out at all stages of treatment: at the main pumping station, mechanical and biological treatment facilities, and sludge treatment.

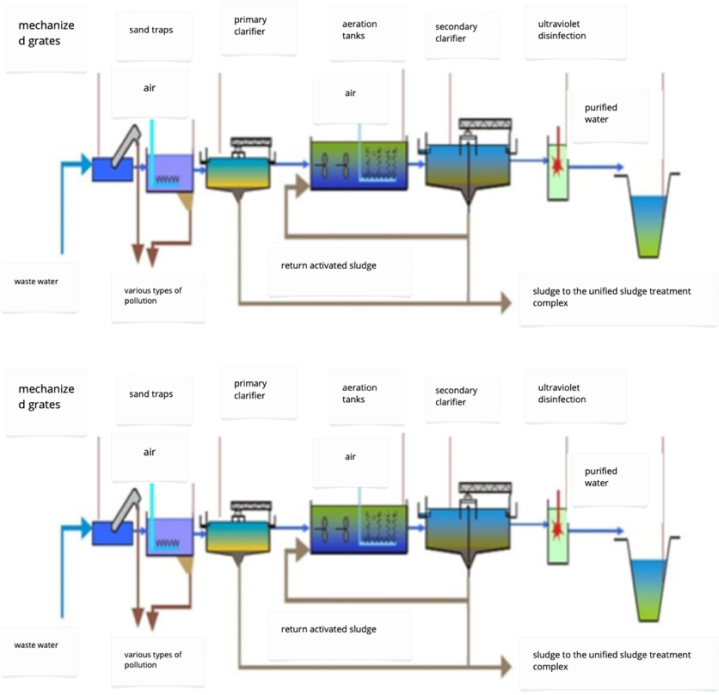

Figure 1 - Process flow diagram of the wastewater treatment plant

The treatment facilities are designed to operate according to the traditional technological scheme of full biological treatment: the first stage is mechanical treatment, which includes straining water on screens, capturing mineral impurities in sand traps and settling water in primary settling tanks; the second stage is biological treatment of water in aero tanks and secondary settling tanks.

The wastewater supplied to the treatment plant contains many different types of contaminants. Two types of mechanized screens with 5- and 6-mm transparencies are used to remove them.

The second stage of mechanical wastewater treatment is sand traps, which are structures used to remove mineral impurities contained in the water entering the treatment plant. Mineral impurities contained in wastewater include sand, clay particles, mineral salt solutions, and mineral oils.

The following conclusions can be drawn based on the analysis of the improvement of wastewater treatment technology at agricultural enterprises:

- Intensification of the technological process of wastewater treatment is not possible without improving regenerative devices;

- The fact that iron-containing impurities in wastewater have magnetic properties determines the possibility of using the method of electrical technologies based on the introduction of magnetic (electromagnetic) purifiers;

- Existing industrial devices and systems for removing mechanical impurities are energy-consuming and inefficient (the level of purification does not exceed 68-75%);

- Further intensification of wastewater treatment requires the development of parameters of the electro-technological system.

REFERENCES

1. Levandovskyi, L.V., Bubliienko, N.O., Semenova, O.I. (2013). Environmental technologies and equipment: textbook. K.: NUHT.

2. An Introduction to Wastewater Treatment. Cambi website. Retrieved from: https://www.cambi.com/blog/wastewater-treatment (accessed 29.12.2024).

3. Petruk, V., Severin, L., Vasylkivsky, I., Bezvoziuk, I. (2014). Environmental technologies. Study guide. Part 2: Methods of wastewater treatment. Vinnytsia: VNTU.

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ВДОСКОНАЛЕННЯ КОНСТРУКЦІЇ БУДІВЕЛЬНОГО 3D-ПРИНТЕРА З МЕТОЮ ВПРОВАДЖЕННЯ У ПРОЦЕС ЗВЕДЕННЯ БАГАТОПОВЕРХОВИХ МОНОЛІТНИХ БУДІВЕЛЬ

Сучасні тенденції розвитку будівельної галузі все активніше спрямовані на впровадження інноваційних технологій, що дозволяють оптимізувати виробничі процеси, зменшити витрати ресурсів і підвищити якість об’єктів.

Однією з таких перспективних технологій є будівельний 3D-друк, який вже зарекомендував себе у зведенні малоповерхових конструкцій. Прикладом реалізації малоповерхового будівництва є будівництво освітнього закладу у

м.Львів за допомогою обладнання для будівельного 3D-друку. Найважливішою перевагою використання 3D-друку в будівництві є гнучкість та можливість створювати складні архітектурні форми й дизайн. Корпус для першокласників було надруковано всього за 48 годин і ця фаза будівництва була завершена протягом двох тижнів. [1]

Проте застосування цієї технології у зведенні багатоповерхових каркасних будівель є відносно новим напрямом, що потребує ґрунтовного вивчення та розроблення новітніх конструкцій будівельних 3D-принтерів.

Впровадження будівельного 3D-принтера у будівельний процес потребує вирішенню ряду технічних проблем, серед яких є: застосування 3D-друку при створенні залізобетону, розроблення конструкції механізму підйому будівельного 3D-принтера.

Перспективним напрямком розвитку технологій будівельного 3D-друку є впровадження цієї технології у будівництво монолітно-каркасних багатоповерхових будівель, а саме заповнення не несних зовнішніх та внутрішніх стін.

Застосування будівельного 3D-принтера при заповненні стін монолітно-каркасної будівлі потребує вдосконалення конструкції наявних будівельних принтерів, а саме, вдосконалення механізмів підйому принтера з поверха на поверх.

Було запропоноване вирішення проблеми розробкою конструкції самопідйомного 3D-принтера на яку був отриманий патент на корисну модель №158378 “САМОПІДЙОМНИЙ 3D-ПРИНТЕР”

Самопідйомний 3D-принтер має раму 1 з вертикальними стійками 2 та поперечними балками 3, 4 і 5. На однійз балок 4 встановлена штанга 6 з екструдером 7, а на інших балках 3 та 5 закріплені вертикальні домкрати 8. Стійки 2 оснащені горизонтальними домкратами 9 та механізмами 10 переміщення стійок 2. (рис. 1)

Зведення будівлі починається з улаштування фундаменту (палі 11 та плита 12). Потім включаютьгоризонтальні домкрати 9, які спираються на плиту 12, та механізми 10 переміщення стійок 2. Виконуєтьсяпідіймання рами 1 та друкування колон 13 першого поверху будівлі і плити перекриття 14

Після набуття твердіння конструкцій 13 та 14, включають вертикальні домкрати 8, виключають горизонтальні домкрати 9 та механізмами 10 підіймають їх до плити 14.

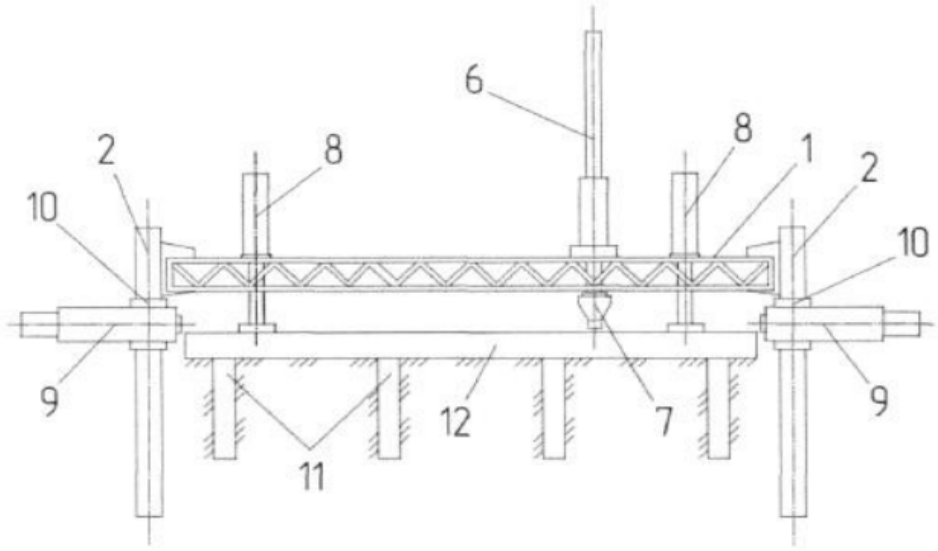

Рис. 1. Схема самопідйомного будівельного 3D-принтера

Потім цикл роботи 3D-принтера повторюється, що забезпечує зведення несучих конструкцій кожного поверху будівлі. На верхньому поверсі будівлі 3D-принтер демонтують та опускають краном на будівельний майданчик. [2]

Застосування данної самопідйомної конструкції дозволить використовувати будівельний 3D-принтер при зведені монолітно-каркасних багатоповерхових будівель, що значно зменшить витрати та збільшить швидкість будівельних робіт.

ЛІТЕРАТУРА

1. Сайт “Інтернет-видання Полтавщина”, “ Використання 3D-друку в будівництві: можливості та перспективи” https://blog.poltava.to/atlant/16536/

2. САМОПІДЙОМНИЙ 3D-ПРИНТЕР : пат. 158378 Україна : E04G 11/24 (2006.01). № u 2024 01707; заявл. 16.07.2024 ; опубл. 29.01.2025, Бюл. № 5

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ОГЛЯД СПОСОБІВ ЗБЕРЕЖЕННЯ ЯКОСТІ ПРОДУКЦІЇ

Під час збору врожаю рослинна продукція постійно проходить фізіологічні процеси дихання та випаровує воду, що призводить до поступового зниження її якості. Активне метаболічне дихання та підвищена активність води в рослинних тканинах є основними причинами швидкого псування продуктів. Саме тому використання ефективних засобів для підтримки якості після збору врожаю є головним викликом для харчової промисловості.

Традиційні методи, такі як сушіння та заморожування, хоча й збільшують термін зберігання, ймовірно, змінюють текстуру, смак та харчові характеристики овочів[1]. Тому охолодження є найкращим методом збереження свіжості без суттєвої зміни характеристик продукту. Слід зазначити, що ефективність охолодження залежить від його часу – важливо охолодити продукт якомога швидше після збору врожаю, щоб зменшити фізіологічні втрати[3].

З відомих методів – повітряне охолодження, гідроохолодження та занурювальне охолодження – кожен з них має деякі недоліки. Зокрема, повітряне охолодження характеризується низькою швидкістю відведення тепла та ризиком висихання поверхні овочів. Гідроохолодження та занурювальне охолодження, хоча й ефективне у відведенні тепла, може спричинити мікробне забруднення продуктів.

Вакуумне охолодження є інноваційною технологією, яка може подолати існуючі недоліки традиційних методів. Вакуумне охолодження базується на природному процесі випаровування вологи в умовах зниженого атмосферного тиску, що призводить до інтенсивного теплообміну. Основними перевагами є висока швидкість охолодження, рівномірний розподіл температури в об'ємі

продукту, чистота процесу та зниження енерговитрат порівняно з традиційними технологіями[4,5,6].

Окрім переваг, вакуумне охолодження має й деякі недоліки. Втрата маси внаслідок випаровування води, нерівномірне охолодження окремих компонентів продукту, особливо листової зелені, вимагають додаткової оптимізації технології. Наразі робляться спроби зменшити втрати маси, вдосконалити конструкції камер та розробити комбіновані технології охолодження[2]. З вітчизняних вчених можна відзначити дослідження вакуумного охолодження плодів черешні. Які вирішили проблему втрати ваги, шляхом додавання додаткової води в камеру охолодження тиском.[6]

Отже, можна стверджувати, що вакуумне охолодження є однією з найперспективніших технологій консервування овочевої продукції після збору врожаю. Будучи високоефективною, швидкою, гігієнічною та енергозберігаючою за своєю природою, ця технологія є багатообіцяючою для широкомасштабного застосування в сучасних ланцюгах свіжих продуктів.

ЛІТЕРАТУРА

1. Alibas, I., Koksal, N., (2014). Convective, vacuum and microwave drying kinetics of mallow leaves and comparison of color and ascorbic acid values of three drying methods. *Food Science and Technology*.
2. Jin, T. (2007). Experimental investigation of the temperature variation in the vacuum chamber during vacuum cooling. *Journal of food engineering*. 333-339.
3. Postharvest, M. (2015). Management of Fruits and Vegetables Storage. In Sustainable Agriculture Reviews; Lichtfouse, E., Ed.; Springer International Publishing: Cham, Switzerland, Volume 15, 65–152.
4. Zhiwei, Zhu, Yi, Geng, Da-Wen, Sun. (2019). Effects of operation processes and conditions on enhancing performances of vacuum cooling of foods: A review, Trends in Food Science & Technology, 85, 67-77.
5. Арестов, А. Ю., & Ломейко, О. П. (2011). Вплив режимів вакуумного охолодження на збереженість та якість плодів черешні. *Наукові праці [Одеської національної академії харчових технологій]*, (39 (1)), 187-190.
6. Ломейко, О. П., & Єфіменко, Л. В. (2016). Використання методу вакуумного охолодження для попереднього охолодження плодів черешні.

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CLASSIC POURED HOT ASPHALT

Despite the widespread use of classic poured hot asphalt concrete (CHAC) in road, bridge and municipal construction the existing approaches to its application remain fragmented and non-standardized. In particular, there is insufficient systematization of mixture composition requirements, a lack of clear technological regulations for different operating conditions and climate zones and limited utilization of the potential of this material in environments where it can offer better technical performance. This necessitates deeper research and optimization of CHAC formulations and laying technology, taking into account modern requirements for durability, waterproofing and cost-effectiveness [2,3].

The main aim of investigation is to analyze the properties, types, composition and technological features of cast hot asphalt concrete mixture (CHACM), as well as to identify its advantages and potential for effective use in modern construction.

Classic poured hot asphalt concrete was invented in Germany under the name “Gussasphalt” and it remained in use to present time. Cast hot asphalt concrete (CHAC) is a monolithic material which is formed without compaction by cooling the asphalt concrete mixture laid and using a mechanized casting technique. The cast hot asphalt concrete mixture (CHACM) is obtained by mixing in a heated state crushed stone, or without it, artificial gravel, mineral powder, bituminous binder, and modifying additives in rational proportions. Depending on the maximum grain size of mineral aggregates, CHACM and CHAC are classified into three types: 5 mm, 10 mm and 15 mm. CHACM is used to construct both upper and lower layers of pavement. This approach is widely used in bridge structure paving [2].

The main area of application of CHAC is bridge construction. At the same time, the material is suitable for road surfaces of all categories and climate zones of Ukraine from A-1 to A-7, as well as for sidewalks, pedestrian and bicycle paths, the intertrack space of tramways. CHAC is also used in industrial and civil construction as a waterproofing material and for the construction of hard surfaces in production and storage areas, screeds, floors followed by grinding and polishing, and apron creation

It is necessary to mention the following features and advantages of using CHAC:

1.Increased content of mineral powder and modified binder in a 3:1 ratio ensures density, low water saturation, water resistance, and impermeability;

2.High plasticity and waterproofing properties due to a complex modified binder content of up to 11% by weight;

3.High corrosion resistance, crack resistance, wear resistance, elasticity, and surface strength;

4.Durability of over 30 years, which helps to reduce costs;

5.Production and laying temperature 200–240° C, no need for compaction, possibility of repair at sub-zero temperatures [1,2].

CHACM of the 4th and 5th types is used for pothole repairs, waterproofing and tramway paving. The maximum grain size of crushed stone is up to 20 mm and the grains' proportion which is greater than 5 mm is 35–50%. They are produced, transported and laid using a cooker, although manual laying is also possible. CHACM is classified by the type of bituminous binder: modified or unmodified. Unmodified variants are rarely used now. Modified ones, mainly with polymer and wax additives, form a thick bitumen film on the surface of the grains, which ensures high water and frost resistance [2,3]. Standard or average values based on data from manufacturers and research are presented in this table.

Name	Max Garin Size, mm	Fraction >5 mm, %	Wear Resistance, g/100 rev.	Production Temp., °C	Advantages and Application
CHAC (5 mm)	5	0–35	100–120	200–240	Upper layers of pavement, pedestrian paths, sidewalks
CHAC (10 mm)	10	35–50	150–170	200–240	Bridges, pedestrian and bicycle paths, screeds
CHAC (15 mm)	15	50–60	200–220	200–240	Tram tracks, pavement repairs
CHAC for pothole repair (20 mm)	20	35–50	250–270	200–240	Pothole repairs, tram track areas
Modified CHAC	5–15	40–55	180–210	200–240	Pavements requiring high frost and water resistance

Table 1. Brief overview of physical and mechanical properties of cast hot asphalt concrete [1,2].

Cast hot asphalt concrete is a modern, versatile material capable of providing durability, strength, and water resistance of pavements even under extreme conditions. Its wide use in various construction fields, as well as the technological simplicity of its application, make it an essential element of sustainable infrastructure. Further research should focus on improving formulations and adapting mixtures to climatic and operational requirements.

REFERENCES

1. National Asphalt Pavement Association. (2017).”Hot Mix Asphalt Pavements”.

2. Солодкий, С.Й., Сідун, Ю.В. (2021). Інноваційні матеріали та технології в дорожньому будівництві. Частина 1. *Матеріали та технології на основі органічних в'яжучих*.

3. Teltayev, B. (2021). Pavement and Asset Management: Advanced Asphalt Materials and Pavement Performance Models. *Springer*.

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CHATGPT INTEGRATION AUTONOMOUS SYSTEMS

The integration of modern language models into autonomous systems opens new horizons for the development of robotics. One of the most effective and sought-after solutions is the use of the ChatGPT API is an intelligent platform for processing and generating natural language text, developed by OpenAI. This API offers a simple and intuitive way for users to communicate with machines, significantly enhancing the functionality of autonomous devices.

Contemporary devices, including household robots, as well as industrial and service machines, require a high-quality and user-friendly interface for interaction. Implementing ChatGPT in these systems enables efficient processing of voice or text commands and translating them into actions. For example, simple phrases such as “Bring me a cup from the kitchen” or “Find a charging station” can be correctly interpreted by the AI and executed as part of the given task.

The system architecture is based on a sequence of actions that involve several technological stages. First, the voice signal is converted into text using a speech recognition system such as Google Speech-to-Text or Whisper. This text is then sent to the ChatGPT cloud service, where it is analyzed and a response is generated in text form. The processed information is passed to the control unit, which interprets it and triggers the necessary action. If needed, the system can provide feedback, voicing the result using a speech synthesizer.

The use of ChatGPT API is especially effective in areas such as service robotics, educational platforms, as well as smart home systems and workplaces. Unlike traditional voice assistants, GPT models can consider the context of communication,

maintain a coherent dialogue, and clarify the user's requirements. For example, a robot might ask: “Do you want me to open the window in the bedroom or throughout the apartment?”, which makes the interaction with it much more natural.

Despite all the advantages, there are several limitations when using such technologies. One of them is the reliance on a stable internet connection, as most language models operate through cloud computing resources. Also, there is a need to implement mechanisms for checking and filtering data coming from the AI to avoid possible errors when processing complex commands.

With the development of local language models that require less computational power and can function without constant internet access, it becomes possible to create fully autonomous dialogue systems. This opens up new opportunities for the use of intelligent interfaces in fields such as healthcare, logistics, and urban infrastructure.

Thus, integrating the ChatGPT API into autonomous systems significantly improves human-technology interaction, turning it into a convenient, flexible, and understandable process. This contributes to the creation of more human-centered technologies, where artificial intelligence becomes not just a tool, but a full-fledged assistant capable of learning, adapting, and supporting dialogue.

REFERENCES

1. OpenAI. (2025). *Introducing ChatGPT API*. Retrieved from: https://openai.com
2. OpenAI. (2025). *ChatGPT Technical Overview*. Retrieved from: https://platform.openai.com/docs/guides/chat
3. Google Cloud. (2025). *Speech-to-Text API Documentation*. Retrieved from: https://cloud.google.com/speech-to-text
4. Whisper. (2025). *Speech Recognition with Whisper*. Retrieved from: https://github.com/openai/whisper
5. Robotics Trends. (2023). *The Rise of Autonomous Robotics*. Retrieved from: https://www.roboticstrends.com

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MECHANICAL ENGINEERING: CURRENT TREND AND TECHNOLOGICAL BREAKTHROUGHS

Mechanical engineering is a dynamic field that is constantly evolving in response to societal demands, industrial challenges, and environmental imperatives. Today, the discipline is undergoing a profound transformation driven by digital innovation, sustainability goals, and the increasing complexity of modern mechanical systems. As with sustainable architecture, understanding the current landscape in mechanical engineering requires not only familiarity with the fundamental principles, but also a willingness to adapt to the rapid pace of technological progress. One of the most influential trends shaping modern mechanical engineering is Industry 4.0, often referred to as the fourth industrial revolution. This approach integrates cyber-physical systems, the Internet of Things, and artificial intelligence into design and manufacturing processes. Smart factories, for example, use real-time data analytics, autonomous machines, and predictive maintenance to increase productivity and reduce downtime. Digital twins (virtual copies of physical systems) allow engineers to model, control, and optimize equipment without physical prototypes, significantly reducing resource consumption and development time.

Closely related to digitization is the development of additive manufacturing, commonly known as 3D printing. Although initially limited to prototyping, modern additive manufacturing enables the creation of complex, lightweight, and customized components from a range of materials, including metals, polymers, and ceramics. This

not only reduces material waste, but also opens up new opportunities for design optimization that were previously impossible with traditional subtractive methods.

Another major breakthrough in the field is the integration of sustainable design principles into mechanical engineering practices. Engineers are increasingly adopting a life-cycle approach to product development, aiming to reduce environmental impacts from production to disposal. Concepts such as «Design for Disassembly» and «Cradle-to-Cradle» encourage the reuse and recycling of mechanical components in line with the circular economy model. In addition, energy-efficient systems such as regenerative braking in electric vehicles or low-energy HVAC systems in buildings are examples of how mechanical engineering contributes to reducing carbon emissions.

Robotics and automation also represent a significant area of innovation. Advances in mechatronics and control systems have led to the development of collaborative robots that work alongside humans in manufacturing environments, increasing efficiency and safety. In addition, biomedical robotics, such as robotic prosthetics and robotic surgeons, illustrate how mechanical engineering intersects with human-centered design to improve quality of life.

Materials science continues to play a crucial role in expanding the capabilities of mechanical systems. Smart materials that can change their properties in response to external stimuli, such as temperature, pressure, or magnetic fields, are being incorporated into actuators, sensors, and structural components. Current innovations are particularly impactful in the aerospace and defense sectors, where adaptability and performance are critical.

Despite these advances, the discipline faces several challenges. As mechanical systems become increasingly complex and integrated with digital technologies, engineers must acquire interdisciplinary knowledge that encompasses software development, data science, and environmental science. In addition, ethical considerations regarding automation and the potential displacement of human labor require careful consideration and policy planning.

Thus, mechanical engineering today is thus characterized by the convergence of digital innovation, sustainability imperatives, and interdisciplinary collaboration. Just as green technologies are revolutionizing architecture, smart manufacturing, additive manufacturing, and sustainable practices are redefining what it means to be a mechanical engineer in the 21st century. With these trends in mind, the industry is not only addressing today's industrial and environmental challenges, but also playing a key role in shaping a sustainable and technologically advanced future.

REFERENCES

1. Ambekar, P. S., Kushwaha, B., Sharma, P., Bosia, F., Fraldi, M., Pugno, N. P., Tiwary, C. S. (2022). Topologically engineered 3D printed architectures with superior mechanical strength. URL: https://arxiv.org/abs/2206.00418.
2. Jin, H., Espinosa, H. D. (2023). Mechanical Metamaterials Fabricated from Self-assembly: A Perspective. URL: https://arxiv.org/abs/2311.06734
3. Mechanical Metamaterial. (2024). Wikipedia. URL: https://en.wikipedia.org/wiki/Mechanical_metamaterial.
4. Mechanical Engineering. (2025). Wikipedia. URL: https://en.wikipedia.org/wiki/Mechanical_engineering.
5. Xu, B., Zhang, P., Zhu, J., Liu, Z., Eichler, A., Zheng, X.-Q., Lee, J., Dash, A., More, S., Wu, S., Wang, Y., Jia, H., Naik, A., Bachtold, A., Yang, R., Feng, P. X.-L., Wang, Z. (2022). Nanomechanical Resonators: Toward Atomic Scale. URL: https://arxiv.org/abs/2208.07164.

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ASBESTOS PROCESSING TECHNOLOGY

In today's world, technological progress has reached a phenomenal level, including significant advancements in mechanical engineering. This paper will focus on breakthroughs in the field of hazardous building material recycling. This is a crucial topic, as it directly impacts both human safety and environmental protection.

Asbestos is considered one of the most dangerous construction materials. Although its production has been banned in many countries, it is still widely used in Central Asia despite its well-documented health risks. Asbestos gained popularity in the 20th century due to its unique properties, such as fire resistance, durability, and chemical stability. It has been widely used in roofing materials, construction boards, insulation panels and more [1].

While asbestos itself is an inexpensive material, the long-term costs associated with its removal and health risks make its use economically unviable. The primary health risks are posed to miners and construction workers who handle asbestos-containing materials. When these materials are mined or damaged, tiny asbestos fibers are released into the air. Once inhaled, these fibers can remain in the lungs for years, leading to severe respiratory diseases [3].

Recently, a Dutch company, Asbeter, developed a patented process called AC Minerals, which enables the safe recycling of asbestos-containing materials. Their method offers an economically efficient solution by utilizing an alkaline water-based process at temperatures below 100°C. The asbestos material is completely ground, turned into a suspension, and dissolved, ultimately transforming into calcium silicate. The final product is certified as a recycled, environmentally safe material [2].

Unfortunately, there are still few companies engaged in asbestos processing. In Ukraine, as in many other European countries, asbestos is isolated in specially equipped facilities in compliance with environmental protection and occupational health standards. Asbestos waste is packed in hermetically sealed containers and then transported to secure landfills [4].

Despite these advancements, the world still faces a significant backlog of asbestos waste. It will take time to completely eliminate it but companies working in this field are continuously innovating.

It is important to remember that future generations will face numerous challenges including environmental ones. The more effort we invest today, the better and safer the world we create for tomorrow.

REFERENCES

1. *Some countries still use asbestos – level 1 - News in Levels*. (2025, March 16). English News and Easy Articles for Students of English. https://www.newsinlevels.com/products/some-countries-still-use-asbestos

2. DW News. (2025, March 14). *Why asbestos is still a billion-dollar industry – with a bright future? | Transforming Business* [Video]. YouTube. https://www.youtube.com/watch?v=JA0p8axpup4

3. Povtak, T. (2025, February 10). *Asbestos abatement: Hiring an asbestos removal company*. Mesothelioma Center - Vital Services for Cancer Patients & Families. https://www.asbestos.com/abatement-guide/

4. Miyamoto International. (2025, February 13). Addressing Ukraine's asbestos crisis - Miyamoto International. *Miyamoto International - Global Engineering Firm with a Humanitarian Focus*. https://miyamotointernational.com/addressing-ukraines-asbestos-crisis/?utm_source=chatgpt.com

Електрична інженерія: енергоефективність та смарт-рішення

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SOLAR POWER SYSTEM for HOME

In recent years, solar energy has become the main source of energy for more and more families. Solar energy is obtained from the sun's radiation and it can be converted to electricity using the latest solar power systems.

A typical solar system consists of solar panels (which absorb sunlight), inverter (which converts DC into AC), mounting structure (that hold the panels in place), batteries (to store the extra power generated), grid box and balance of systems (wires, nuts etc.) [1].

If you plan to install a solar power system, you should keep in mind that solar energy, just like any other power source has various advantages and disadvantages.

A major benefit of solar energy technology is that it is a sustainable alternative to fossil fuels. The sun is an infinite source of energy, unlike coal and natural gas, and solar panels can be installed practically anywhere. This is particularly useful for remote regions with no access to any other source of electricity. Solar energy does not pollute the environment. It does not produce greenhouse gases and does not pollute the water. Solar energy will be accessible as long as we have the sun [2].

Furthermore, solar can either greatly reduce or totally eliminate your electric bills. It means when you install solar power for your home, you generate your own electricity, become less reliant on your electric utility. This will immediately translate to savings on your energy bill [3].

Also you can make money by selling the unused electricity, which you have generated, back to the grid.

Besides once installed, solar panels require little maintenance and has longevity. They are safer than traditional electric current [4].

Although solar energy provides a variety of benefits, there are some negative factors to consider as well.

First of all, this is a high initial cost. To purchase a solar energy system, you need to pay for the panels, a substantial number of batteries, wiring, and then pay more for all the components to be installed.

Moreover, solar panels are dependent on sunlight to effectively gather solar energy. Consequently, if you live in an area prone to cloudy days for an extended period, this will negatively impact how the system runs. And your system will likely be less productive [2].

In addition, a solar energy system takes up a lot of space. It depends on how much energy you are trying to produce. Therefore, solar panels might be inconvenient in inner cities and other areas with limited space [5].

To sum up, I would like to say that certainly solar power is becoming an increasingly popular investment for homeowners. However, looking at the advantages and disadvantages of solar energy is an important step in the research process when considering installing solar panels for your home.

REFERENCES

1. *Greenenergy Solar System*. (n.d.) https://www.greenergysolarsystem.in/latest-update/off-grid-solar-systems-off-gr/37
2. *The advantages and disadvantages of solar energy*. (n.d.). Constellation. https://www.constellation.com/energy-101/energy-innovation/solar-energy-pros-and-cons.html
3. *7 Benefits of Using Solar Energy*. (n. d.) https://www.smartelec.info/solar-power
4. *17 Advantages & Disadvantages of Solar Energy (May 2025)*. (2025, February 19). GreenMatch.co.uk. https://www.greenmatch.co.uk/solar-energy/pros-and-cons
5. *Solar Energy Definition*. (2025, Apr 15). https://www.geeksforgeeks.org/solar-energy/

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CYBER DEFENCE FOR NEXT-GENERATION POWER GRIDS

Smart grid technology promoted modernization of the power grids to unprecedented levels of efficiency, reliability, and sustainability in energy distribution. However, this transition also introduced a high-tech cybersecurity scenario that has to be given priority. Smart grids differ from traditional power grids as they rely heavily on digital data communication networks, IoT devices, and real-time data exchange, leaving them vulnerable to cyberattacks that could affect critical infrastructure. The interconnected nature of smart grids means one hack could cascade into widespread power blackouts, economic losses, and even public safety risks. One of the largest cybersecurity challenges in smart grids is the sheer volume of connected devices.

Each piece of equipment, from smart meters to grid sensors and control systems, is a potential entry point for hackers. Most of these devices operate legacy systems with outdated security protocols, making them susceptible to attacks. A compromised SCADA system would let attackers remotely trip circuit breakers, alter voltage levels, or remotely shut down substations, causing blackouts. Another concern is that there are no standardized security protocols in smart grid elements. Smart grids combine operational technology (OT) and information technology (IT), and each has its distinct security requirements.

Most OT systems were designed with reliability rather than security as a concern, and are poorly positioned to handle today's cyberattacks. For example, industrial control systems (ICS) typically use proprietary communication protocols with no encryption at all, and attackers can sniff and modify data. Furthermore, third-party vendors and cloud resources created avenues of additional vulnerability because

each outside interface expands the attack surface. A breach of vendor systems could provide attackers with a backdoor into the heart of the infrastructure of the grid. Ransomware attacks present another severe risk to smart grids with increasing frequency of such attacks. Cyber attackers are increasingly targeting critical infrastructure with the knowledge that energy providers can't afford extended outages. Several high-profile attacks over recent years have demonstrated the havoc caused by ransomware on power grids.

Attackers commonly use weak authentication techniques or phishing campaigns to get initial access, then introduce malware that encrypts useful data and demands a ransom for its release. Even payment does not guarantee systems will ever fully recover, and the damage may take weeks to repair. In addition to monetary rewards, state-sponsored actors could launch attacks for the purpose of destabilizing a region or to gather intelligence regarding grid operations. These attacks often make use of advanced persistent threats (APTs), which are not detected for long periods of time as they hack sensitive data or strategize for large-scale disruption. Human factors also enter the picture when it comes to the cybersecurity of smart grids. Many breaches occur due to lack of attention by employees, such as being tricked into phishing emails or using weak passwords. Technology advancements aside, human errors continue to be one of the weakest links in security chains. Training initiatives and awareness campaigns can minimize this risk, but these must be ongoing to offset new threats.

Without experts to monitor networks, identify intrusions, and respond to security breaches, utilities are vulnerable to what might otherwise be thwarted attacks. To address these concerns, a multi-layered defence strategy is required. First, utilities must adopt robust encryption methods to encrypt data in transit and at rest. End-to-end encryption will ensure that even if data is intercepted, it will not be readable without the proper keys. Second, continuous monitoring and anomaly detection software can identify suspicious activity before it reaches its full potential as an attack. Machine learning (ML) and artificial intelligence (AI) are increasingly being used to analyse vast amounts of grid data in real-time and flag deviations from normal patterns.

Third, regular vulnerability scans and penetration testing can identify vulnerabilities before the attackers discover and exploit them. These tests simulate cyberattacks to test the resilience of grid networks and recommend fortification. Regulatory guidelines also constitute an essential component in the protection of smart grids. Governments and industry bodies must formulate stringent cybersecurity rules that mandate regular audits, incident reporting, and compliance checks. Attackers are constantly inventing new ways of attack, from zero-day exploits to AI-driven attacks, and utilities must always be on the leading edge. Future quantum computing advancements can make it even more difficult, as encryption methods used today may become obsolete. But smart investment in cybersecurity infrastructure, workforce training, and research can always counter these threats.

The transition to smart grids is irreversible, offering too many benefits to be ignored. Yet, the cyber threats they introduce cannot be overlooked. One successful attack would undermine public trust in smart grid technology and decelerate its adoption. By prioritizing security at every level—from making devices to running the grid - utilities can create resilient systems that can withstand cyberattacks while promising a more efficient, more intelligent energy future. A great deal is at stake, but with the right measures in place, the smart grid can be secure and innovative.

REFERENCES

1. Bernstein, D. J., & Lange, T. (2017). Post-quantum cryptography. *Nature*, *549*(7671), 188–194. https://doi.org/10.1038/nature23461

2. Konstantinou, C., & Mohanty, S. P. (2020). Cybersecurity for the smart grid. *Computer*, *53*(5), 10–12. https://doi.org/10.1109/mc.2020.2975901

3. Velayutham, Y., & Bakar, N. (2020). Iot security for smart grid environment: Issues and solutions. *Jordanian Journal of Computers and Information Technology*, 1. https://doi.org/10.5455/jjcit.71-1595835783

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ENERGY SOLUTIONS FOR DESIGNING SELF-SUSTAINING UNIVERSITY CAMPUSES IN UKRAINE

Universities play an essential role in shaping future generations, and their campuses should reflect the same commitment to sustainability that they impart to their students. Sustainable energy solutions are pivotal in transforming university campuses into self-sustaining ecosystems that efficiently manage energy needs, reduce carbon emissions, and adapt to changing world challenges. By integrating renewable energy technologies, optimizing energy consumption, and fostering a culture of sustainability, educational institutions can promote environmental resilience.

Traditional university campuses are among the largest energy consumers, relying heavily on fossil fuels for electricity, heating, and cooling. Laboratories, dormitories, libraries, and sports facilities often demand high electricity. This dependence accelerates climate change, exposes institutions to fluctuating energy prices, and creates vulnerabilities in regions with unreliable grids. Conflict zones and economically fragile areas face additional strains, where disruptions to energy supplies directly affect education and research.

Ukraine's energy landscape faces significant challenges, marked by a 35% reliance on imported fossil fuels (as of early 2024), geopolitical vulnerabilities threatening energy security, and escalating costs that saw a 20% rise in 2023. Yet, amidst these pressures, a need for designing self-sustaining university campuses powered by renewable energy and driven by efficiency emerges. This transition aligns with the government's ambitious goal of 25% renewable energy by 2035 and offers a pathway to greater resilience, economic savings, and a reduced carbon footprint.

The case for energy independence on university campuses is compelling. With an average campus emitting 15,000 tonnes of carbon dioxide (CO_2) annually, shifting towards cleaner energy is a crucial step in environmental stewardship. Moreover, self-sufficiency enhances energy resilience, shielding institutions from the uncertainties of external supply. These innovative campuses can also serve as powerful magnets for talent, showcasing cutting-edge energy solutions. Economically, the transition promises significant returns, with expected energy expense reductions of 15-20%.

Ukraine boasts substantial renewable energy potential that is waiting to be harnessed. The sun-drenched southern regions offer an average solar irradiation of 4.2 kWh/m²/day, making solar photovoltaic (PV) a prime candidate for integration. Wind power thrives along the coasts and open plains, providing another robust, clean energy source. The nation's strong agricultural sector presents opportunities for biomass utilisation through waste and energy crops, while select regions hold geothermal potential for heating and cooling.

Integrating solar PV is a tangible and increasingly cost-effective solution. Rooftop installations, exemplified by KhPI University's 500 kW array, and innovative solar carports can significantly offset campus electricity needs, potentially covering 30-40% with installation costs averaging £0.70-£0.90 per watt. For rural campuses, small-scale wind turbines offer a valuable distributed energy resource, and combining solar and wind in hybrid systems enhances reliability. Careful planning and mitigation strategies can address potential noise and visual impacts.

Biomass heating and Combined Heat and Power (CHP) systems present another promising avenue. As demonstrated by Lviv National Agrarian University, utilising agricultural waste for heating can slash heating costs by up to 50%. CHP systems further enhance efficiency by simultaneously generating heat and electricity.

Beyond renewable energy generation, a joint effort towards energy efficiency is crucial. Implementing robust insulation and retrofitting existing buildings can yield 20-30% reductions in heating and cooling demands. Smart building management systems

can optimize energy use, while transitioning to LED lighting offers dramatic energy savings of up to 75%.

Global examples underscore the viability and benefits of this transition. Universities in the UK and Germany have successfully integrated renewables, while Danish campuses lead in energy efficiency. The Masdar Institute in the UAE showcases the potential for net-zero energy campuses. A key lesson from these successes is the vital role of community engagement.

In conclusion, the path towards self-sustaining university campuses offers Ukraine a resilient and environmentally sound energy future. Realizing this vision requires supportive policies and strategic investments to accelerate the adoption of renewable energy and energy efficiency measures. By embracing innovation and fostering broad collaboration, Ukrainian universities can pave the way for a greener future, yielding significant environmental and economic benefits for both the institutions and the nation as a whole.

REFERENCES

1. Deshko, V. I., & Shevchenko, O. M. (2013). University campuses energy performance estimation in Ukraine based on measurable approach. *Energy and Buildings*, *66*, 582–590. https://doi.org/10.1016/j.enbuild.2013.07.070

2. Janikova, J. (2021). Creating efficiency model of higher education institutions. *SHS Web of Conferences*, *91*, 01047. https://doi.org/10.1051/shsconf/20219101047

3. Oliveira, M. C., & Proença, J. (2025). Sustainable campus operations in higher education institutions: A systematic literature review. *Sustainability*, *17*(2), 607. https://doi.org/10.3390/su17020607

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GRAVITY POWERED ENERGY GENERATORS AND STORAGES

Due to the high energy needs, a lot of attention is paid to the use of alternative energy sources and the possibility of its storage. Due to the instability of renewable sources, it is important to ensure the possibility of accumulating excess electricity for further use in times of increased demand. Energy storage technologies play a key role in ensuring the reliability of energy systems, contributing to the stable operation of the network and creating conditions for the large-scale implementation of green energy.

Storage is a key element in ensuring the stability and efficiency of electricity grids, which is very important in the context of the growing share of renewable energy sources. Among the main energy storage technologies, the following can be distinguished:

• Lithium-ion batteries: These systems provide high energy density and fast response, which makes them suitable for balancing power systems. For example, Tesla is implementing projects using Megapack in Japan (548 MWh), Belgium (200 MWh) and the United Kingdom (15 MWh), demonstrating large-scale and efficient projects using this technology.

• Gravity energy storage systems: Technologies that use the energy of lifted loads have the ability to store energy for a long time. Energy Vault has implemented a 25 MW commercial EVx system in China and is developing a hybrid system in Italy, combining gravity storage with lithium-ion batteries to increase grid flexibility.

Gravity generators are an innovative type of energy systems that use the potential energy of massive objects to generate electricity. Their principle of operation is to convert the energy of the gravitational fall of a load into a torque, which, in turn, drives

an electric generator. In the “charging” state, the system accumulates energy by lifting the load using an external power source, and in the “discharging” mode, it converts the reverse motion into mechanical and electrical energy. It is precisely because of its high energy efficiency that this technology can easily replace the battery energy storage systems we are used to. Their main advantages are environmental safety and durability, which have an important impact on the environment. As mentioned earlier, outdated mines and industrial facilities can be used for such structures.

It is extremely important to use energy conservation methods for its productive use. First of all, storage installations allow to balance fluctuations in energy production and use. In addition, systems of this type affect the optimization of the load on the network. The biggest advantage is a high level of energy efficiency. An important advantage is also an increase in energy efficiency, since energy storage systems are aimed at minimizing energy costs associated with forced shutdown of generators or excess energy. In addition to the advantages of the technical type, energy storage technologies play an important role in the decarbonization of the energy sector. It is the development and implementation of energy storage systems that is a determining factor in the formation of a long-term, flexible and environmentally sustainable system of energy storage and use.

For Ukraine, in the context of post-war reconstruction, the implementation of such technologies for energy conservation will be incredibly relevant. The use of obsolete mines to create gravity batteries can be an effective solution for Ukraine, given the presence of a large number of abandoned coal mines. The implementation of such a strategy will contribute to the effective conservation of excess energy, which will affect the creation of a stable energy system for critical infrastructure.

Summarizing all the information presented in this report, we can confidently state that energy conservation is an extremely important factor in the development of modern infrastructure, paying attention to the transition to renewable energy sources. They can ensure both efficiency and stability of the energy system. It is worth paying attention to gravitational storage systems, which will be easy to implement in Ukraine,

due to the large number of abandoned mines. This introduction into our energy system will bring stability and proper energy distribution. In the future, critical infrastructure will always be provided with electricity, due to its reserves. Storage technologies can form a sustainable energy system that will meet needs and standards.

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WIRELESS POWER TRANSFER FOR SMART HOMES AND INDUSTRIAL AUTOMATION

The rapid rate at which smart technologies change requires high power transfer efficiency solutions, so Wireless Power Transfer (WPT) is a revolutionary technology. Without physical connectors, WPT offers enhanced convenience, safety, and automation, changing residential and industrial environments and enabling innovative device connection and system configurations. This article explores WPT's use in smart homes and industrial automation, examining its basic principles, current implementations, advantages, and the barriers to widespread adoption.

WPT transmits electrical power wirelessly using various electromagnetic methods. Like current wireless telephone charging, electromagnetic induction employs coils to establish a magnetic field for energy transmission nearby. While efficient for small electronics, it faces limitations in range and alignment sensitivity. Resonant magnetic coupling enhances this by matching transmitter and receiver resonant frequencies, enabling more efficient power transfer over greater distances. Far-field techniques, employing radio frequency (RF) or microwave transmission for longer ranges, suffer from reduced efficiency due to energy dispersion. Each method presents

unique trade-offs between transmission distance, power capacity, and efficiency, crucial considerations for application-specific WPT system design.

WPT is emerging in smart home environments. As an extension to daily wireless charging plates, the technology is being pushed further toward powering combined systems and entire devices. Next-generation kitchens may have WPT-infused countertops that wirelessly charge blenders, coffee machines, and induction cooktops, adding convenience and elegance. Similarly, home furniture businesses are integrating WPT coils to simultaneously charge several devices, saving space. WPT for home lighting facilitates wire-free LED installations, encouraging creative lighting designs and simplified installations. Wireless charging points can be utilized independently by home automation systems, such as robot vacuum cleaners and smart assistants. But to obtain these applications takes overcoming technological barriers like creating more alignment-resistant systems, improving efficiency across various distances, and being universally compatible.

Industrial environments provide tremendous opportunities and challenges in the application of WPT. With the age of Industry 4.0 and smart factory, WPT can replace maintenance-power consuming power cables and batteries for sensors, actuators, and mobile robots. Industrial IoT sensors, especially condition monitoring sensors in inaccessible locations, can be significantly improved by constant operation by WPT without battery replacement and cabling. AMRs can be operated continuously with wireless charging stations placed strategically, enhancing productivity with less downtime. Moreover, WPT facilitates deployment in hostile environments that are not compatible with traditional power solutions. However, industrial applications must address major technological challenges such as electromagnetic interference caused by equipment, power loss in metal-rich environments, and the need for high-power WPT systems for heavy loads. In addition, stringent safety and reliability requirements, above consumer-grade, must be attained.

Future R&D are the solution to overcome current WPT limitations and extend its applications. Dynamic electric vehicle charging would enable continuous usage, and

RF-based wireless power transmission would enable room-wide wireless power transfer. Technologies for more efficient power conversion and adaptive tuning will drastically increase power transfer efficiency regardless of distance and alignment differences. However, for this potential to be attained, technology should evolve, and safety standards and regulations should be formulated in an all-encompassing manner. The economic benefits of mass production and technological maturity will determine extensive adoption in consumer and industrial markets.

As society evolves towards more networked and automated environments, WPT is poised to influence the future significantly. By freeing designers from the constraints of wired power, WPT enables innovative product designs, system architectures, and energy paradigms. While efficiency, standardisation, and implementation cost issues remain unresolved, advantages for smart homes and industrial automation make WPT a promising technology. When the technology matures and systems are optimized to the best of their capabilities, we can expect living and working areas where energy is as present as air, remaking the basic interface with electrical power and devices it enables.

The mass adoption of WPT will call for a joint effort by manufacturers, producers, and researchers, but the benefits are more than worthwhile. In the home, WPT ensures unparalleled design freedom and convenience, and commercial applications are apt to enjoy increased reliability, reduced maintenance costs, and enhanced efficiency. With the continuing development of such technologies, intersection with other future trends, such as energy harvesting and smart grid integration, could lead to comprehensive wireless power ecosystems, redesigning the map of power delivery in personal and public spaces. The future of wireless power isn't just cordlessness; it's about power for a generation of completely standalone smart devices and systems.

REFERENCES

1. Song, D., Shi, F., & Liu, W. (2020). Design and optimization of magnetic coupled resonant wireless power transfer system at weak - coupling region. *Journal of Physics: Conference Series*, *1449*, 012006. https://doi.org/10.1088/1742-6596/1449/1/012006

2. Zhang, Z., Georgiadis, A., & Cecati, C. (2019). Wireless power transfer for smart industrial and home applications. *IEEE Transactions on Industrial Electronics*, *66*(5), 3959–3962. https://doi.org/10.1109/tie.2018.2884307

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UKRAINE'S SHIFT TOWARDS A LOW-CARBON ENERGY SYSTEM

Decarbonisation of the energy sector in Ukraine is a difficult but unavoidable transition in accordance with global efforts to contain climate change, while ensuring energy security and economic stability. As a country with a historically coal-based energy system and high reliance on imported fossil fuels, Ukraine faces challenges and opportunities for a transition towards a cleaner energy future. The decarbonisation trajectory is determined by national policy decisions, international cooperation, technological innovation, and geopolitics.

Ukraine has been historically dependent on nuclear energy, gas, and coal for power generation. Even though nuclear power is utilized for the production of low-carbon electricity, power plants based on coal remain a significant source of carbon emissions. Detoxifying Ukraine from coal is not merely an environmental priority but also an economic and social necessity because a large part of the nation relies on coal mining as a means of livelihood. Phasing coal gradually out to give way to renewable energy sources would mean colossal investment in infrastructure, retraining the workforce, and regional development initiatives for equitable transition.

Ukraine has, in recent years, been supportive of the development of renewable energy. Wind power, solar energy, and biomass power have developed very large scale, with various policy incentives such as feed-in tariffs and auctions for renewable power plants. However, with these developments, renewables are still quite a small part of the country's total electricity production. More can be done to scale up the installations of clean energy technologies, enhance grid resilience, and improve energy storage capacity in order to make a grid powered by renewables reliable.

Energy efficiency is a second pillar of decarbonisation in Ukraine. Many buildings, factories, and industrial units are fitted with old technologies that consume excessive amounts of energy. Switching to energy-efficient technologies, such as heating system modernisation and insulation improvements within residential and commercial real estate, will lower total energy demand. Industrial processes also can be improved by initiating low-carbon technologies, thereby making manufacturing industries more environmentally friendly at the expense of reduced emissions.

International partnership matters in Ukraine's decarbonization. The European Union has been a major source of support for energy reforming, through technical assistance, funding, and connection to larger European energy systems. Strengthening ties with EU energy policy and adherence to international climate commitments enhance the attractiveness of Ukraine to investment and access to clean technologies needed for the transition. International organizations and financial institutions also provide channels for financing major renewable energy projects.

Geopolitical factors play a significant role in the energy transition of Ukraine. The country has long relied on the importation of natural gas, dominated by Russian energy supplies, which has been economically and security-challenging. Diversification of the sources of energy and development of indigenous energy production from renewable sources increase Ukraine's energy autonomy and resistance to external pressures. The ongoing war has even more emphasized the need to develop an autonomous, sustainable energy sector capable of sustaining recovery and long-term economic stability.

Decarbonization of Ukraine's transport sector is another key part of the transition. While most of the focus has been on power generation, reductions in emissions from transport will be key to delivering climate targets. Charging points for electric vehicles, public transport incentivization, and promotion of sustainable urban transport can significantly reduce emissions from road transport. Green hydrogen and biofuel investments can also support reducing fossil fuel reliance.

The role of technology and innovation in Ukraine's decarbonisation can never be overstressed. Advances in battery storage, digital energy management systems, and smart grid technology enhance efficiency while facilitating the grid integration of renewables. Leveraging digitalisation to manage energy consumption patterns, optimize production, and forecast demand will guarantee system reliability with reduced emissions. Encouraging research and development in clean technology will ensure that Ukraine becomes competitive in the global green economy.

Public awareness and education play a significant role in successful energy transformation. Encouraging energy-saving behaviour, developing a sustainability culture, and public participation in decision-making can accelerate decarbonisation measures. Government policies should be supported by local-level measures and consumer activity to provide sustainable energy in the long term.

While it has been a battle, Ukraine possesses a one-time opportunity to transform its energy sector into a model of resilience and sustainability. By adopting sound policy frameworks, global cooperation, technological innovation, and social mobilization, the country can achieve significant carbon emission reductions as well as sustain economic growth. By prioritizing the growth of renewable energy, improving the efficiency of energy use, improving infrastructure, and embracing clean technologies, Ukraine can bring in a greener future and contribute to global efforts towards mitigating climate change.

REFERENCES

1. Agarwal, A., & Sharma, T. (2025). Integrated energy system modeling perspectives for future decarbonization pathways based on sector coupling, life-cycle emissions and vehicle-to-grid integration. *Renewable and Sustainable Energy Reviews*, *215*, 115620. https://doi.org/10.1016/j.rser.2025.115620

2. Petrović, S. N., Diachuk, O., Podolets, R., Semeniuk, A., Bühler, F., Grandal, R., Boucenna, M., & Balyk, O. (2021). Exploring the long-term development of the ukrainian energy system. *Energies*, *14*(22), 7731. https://doi.org/10.3390/en14227731

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ENERGY EFFICIENCY AND SMART SOLUTIONS IN ELECTRICAL ENGINEERING

To begin with, modern power systems face challenges in increasing efficiency and reducing environmental impact. Innovative technologies, including smart grids, automated energy management systems, and renewable energy sources significantly enhance electricity usage efficiency [5].

This paper examines modern approaches to improving energy efficiency in electrical engineering. Special attention is given to the use of smart technologies for optimizing energy consumption and reducing losses [4]. The analysis of recent trends and their impact on industry development is provided along with prospects for future research [3].

The most popular smart technologies in electrical engineering include:

1. Smart Grids

Smart grids enable efficient electricity distribution by minimizing losses through intelligent monitoring and control [2].

2. Energy-Efficient Devices

Modern energy-efficient devices such as variable frequency drives, LED lighting and energy-saving converters significantly reduce power consumption [4].

3. Renewable Energy Sources

Integrating renewable energy sources such as solar and wind power plants reduce dependency on fossil fuels [5].

4. Automated Control Systems

Automated energy management systems minimize electricity losses and enhance distribution efficiency through real-time monitoring and predictive algorithms [1]. The adoption of energy-efficient technologies such as IoT-based monitoring (Internet of Things) and AI-driven optimization reduces consumption, improves grid stability and prevents overloads [2].

Additionally, integrating renewable energy sources helps lower environmental impact by reducing dependence on fossil fuels and cutting greenhouse gas emissions.

Making conclusions, it is necessary to highlight that these smart solutions contribute to a more sustainable, reliable and eco-friendly energy system [3].

REFERENCES

1. DSTU 3008-2015. Documentation. Reports in the field of science and technology. Structure and rules of design.
2. IEEE Power & Energy Society. Smart Grid Research and Applications [Electronic resource]. – Access mode: https://ieeexplore.ieee.org
3. Kovalenko V.I. Energy efficiency and alternative energy: a textbook. – Kyiv: Technika, 2021. – 280 p.
4. Smith J., Brown K. Energy Efficiency in Electrical Engineering. – London: Springer, 2022. – 350 p.
5. International Energy Agency. World Energy Outlook 2023. – Paris: IEA, 2023.

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ENERGY EFFICIENCY IN THE RESIDENTIAL SECTOR: CURRENT TECHNOLOGIES AND PROSPECTS

In times of martial law, the issue of energy efficiency is of particular importance. Apart from direct destruction, military conflicts pose additional challenges to the country's energy system, economy and infrastructure. Ensuring a stable supply of energy becomes critical for military needs, as well as for maintaining the livelihoods of the civilian population and preserving economic stability. Therefore, the implementation of energy efficiency measures that allow for more rational use of energy resources is not only economically feasible, but also strategically important (Поровський, 2024).

In today’s world, energy efficiency is one of the key components of sustainable development. Most developed countries have already made significant progress in this area, and for some of them it was a matter of economic survival. Ukraine, which is currently facing numerous challenges in the energy sector, can learn valuable lessons from other countries. We have analysed some of them: Germany, Denmark, Finland and Japan.

Germany is a leader in energy efficiency and the implementation of Energy Management Systems (EnMS) through a comprehensive approach that includes legislative initiatives, financial incentives and educational programs. The country has financial incentives for the implementation of EMSs in industry through tax reductions on EMS investments; in the residential and public sector, they have a system of energy efficiency certificates for buildings that stimulates the modernization of old housing stock and the construction of new energy efficient buildings. The government provides additional incentives for financing energy efficiency and energy substitution projects

through soft loans and grants (covering partial loans) for both energy efficiency and renewable energy.

Denmark is one of the countries for which the implementation of energy efficiency measures was a matter of survival after the oil crisis in the 1970s. The fatal shortage of energy resources and funds for them in the context of almost 95% dependence on oil imports led Denmark to maximise all possible energy efficiency measures in the domestic and industrial sectors, and to reduce dependence on energy imports, it created many renewable energy generation facilities, primarily wind farms, and successfully reintegrated coal-fired thermal power plants into biomass. As a result, the country has become one of the most energy-efficient in the world in 25 years, transforming from being completely energy-dependent to completely energy-independent and having more than 120% self-sufficiency in energy resources in the late 90s and early 2000s. Currently, thanks to the implemented energy efficiency measures, wind power, and biomass heat generation, the country almost fully meets its energy needs, and the Danish energy system is integrated with the energy systems of Sweden and Norway.

Finland is an example of successful implementation of high energy efficiency standards in construction. Thanks to strict requirements for thermal insulation, ventilation and energy conservation, new buildings in the country consume minimal energy. The government also actively supports the modernisation of the existing housing stock through financial incentives, a system of voluntary agreements with businesses, and educational programmes for the public.

Japan is known for its innovative approaches to energy efficiency in the industrial sector. The introduction of automation technologies, the use of energy-efficient equipment and the optimisation of production processes have significantly reduced energy consumption at enterprises and significantly increased generation efficiency. For a country that is dependent on energy imports, it is energy efficient technologies that have enabled it to become a top global economy and to be firmly in the top three most energy efficient countries. Government programmes encourage

businesses to invest in energy-efficient solutions through tax breaks and subsidies. However, the most influential element is the cultural and behavioural development element - the implementation of energy efficiency measures is a national priority at the societal level. Businesses in Japan are most afraid of public pressure if they inadvertently fail to meet their energy optimisation targets.

Due to the low energy efficiency of the economy, Ukraine spends an additional USD 1 billion annually. Therefore, the implementation of energy-saving solutions is a necessary component of the strategic development of our country. On a practical level, energy efficiency is a component of the survival and development of businesses and communities (Степаненко, 2010).

Consequently, there is currently no possibility of large-scale financing of energy saving projects in the residential sector of Ukrainian cities. It is necessary to support investment projects for thermal modernisation of residential and public buildings on a long-term basis at the legislative level with a transition to combined development financing using external loans, budget support and investor funds.

Ukraine, which consumes more than 60-70% of imported energy resources in its total balance sheet, is one of the most energy-dependent countries in Europe. This is caused not only by the lack of resources but also by inefficient use of resources. Therefore, addressing energy saving and energy efficiency is a top priority in the context of the energy crisis in the country.

The introduction of renewable energy sources is a highly effective way to improve the energy efficiency of residential buildings.

Thus, improving the energy efficiency of residential buildings during reconstruction is extremely important today. This will help to reduce the amount of energy used and thus reduce costs (Вознюк, 2020). Improving energy efficiency will significantly reduce the use of energy resources, which in turn reduces the need to provide the same amount of energy resources, and therefore less greenhouse gas emissions will be released into the atmosphere.

REFERENCES

1. Поровський С. (2024). Енергоефективність в умовах військового стану: життєва необхідність та стратегія розвитку *Sustainability leaders guide.* №6. Available at: https://ukraine-oss.com/energoefektyvnist-v-umovah-vijskovogo-stanu-zhyttyeva-neobhidnist-ta-strategiya-rozvytku/ (accessed February 27, 2025).

2. Степаненко І. (2010). Проблеми та перспективи розвитку енергоефективності в житловому секторі міст України. *Ефективна економіка.* № 11. Available at: http://www.economy.nayka.com.ua/?op=1&z=394 (accessed March 19, 2025).

3. Вознюк І. (2020). Проблема енергозбереження та шляхи її вирішення у багатоквартирних житлових будинках [Електронний ресурс] / І. М. Вознюк, В. П. Ковальський, А. В. Ковальський // Матеріали XLIX науково-технічної конференції підрозділів ВНТУ, Вінниця, 27-28 квітня 2020 р. – Електрон. текст. дані. – 2020. – Режим доступу: https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp-2020/paper/view/9539.)

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ENERGY-EFFICIENT RECONSTRUCTION OF UKRAINE'S CIVIL INFRASTRUCTURE: STRATEGIC PRIORITIES, CHALLENGES, AND IMPLEMENTATION PATHWAYS

During the ongoing war context, Ukraine faces an unprecedented challenge: rebuilding its destroyed infrastructure. However, this challenge also presents a unique opportunity to embed energy efficiency as a core principle of reconstruction. Energy-efficient rebuilding not only reduces energy consumption but also enhances economic feasibility, environmental sustainability, and quality of life for citizens.

Ukraine continues to align its legislation with European Union directives. Key legal instruments include:

- Law of Ukraine No. 3764-IX, which regulates the powers of state authorities in the field of energy efficiency and establishes a clear hierarchy of institutional responsibilities (Official Law Portal). [1]

- Cabinet of Ministers Resolution No. 1228-r (29.12.2023), which outlines a roadmap for implementing the "Energy Efficiency First" principle in residential and public construction (Resolution Text). [2]

Furthermore, Ukraine's decarbonization strategy toward 2050 envisions a complete transformation of the building stock to Near-Zero Energy Building (NZEB) standards by 2027.

NZEB standards (Near-zero Energy Buildings) imply:

- Superior insulation with thermal transmittance (U-value) below 0.15 W/m²K;
- Passive solar energy utilization;
- Mechanical ventilation with heat recovery systems;
- Integration of renewable energy sources (solar panels, heat pumps, biomass).

Example: Newly constructed modular housing settlements in Irpin and Borodianka have incorporated solar collectors and thermal pump systems, partially applying NZEB principles.

Municipalities play a central role in implementing energy efficiency policy. The introduction of Energy Management Systems (EMS) at the local level enables:

- Identification of high-energy-consuming assets;
- Real-time energy consumption monitoring;
- Targeted planning of reconstruction projects.

Case Study: The city of Slavutych is among the first in Ukraine to implement EMS, achieving a 27% reduction in public building energy consumption over two years.

Reconstruction requires significant financial resources. Key sources of funding include:

- Ukraine's Energy Efficiency Fund, which modernized the "Energy Home" program in 2024 to support thermal modernization projects;

- "Renewables for a Resilient Ukraine (R2U)" project in partnership with Germany, focusing on equipping critical infrastructure with renewable energy; [3]
- EU Covenant of Mayors - East, supporting Ukrainian communities in developing Sustainable Energy and Climate Action Plans (SECAPs).

Ukraine actively adapts best practices from EU countries:

- In Poland, large-scale thermal retrofitting programs are managed by municipal energy agencies;
- In Germany, the state covers up to 40% of costs for upgrading buildings to KfW energy standards;
- Lithuania operates a centralized digital system for energy monitoring in public buildings, enabling real-time efficiency management.

Current barriers to energy-efficient reconstruction include:

- Low awareness among stakeholders and professionals;
- Lack of incentive mechanisms for developers;
- Insufficient coordination between national and local authorities;
- Deficit of trained personnel in energy-saving technologies.

Recommendations and a strategy for the development of energy-efficient reconstruction must necessarily include:

- Expansion educational and training programs for architects, engineers, and energy managers.
- Establishment financial incentives, such as tax benefits for developers using renewable technologies.
- Enhancing project evaluation criteria to prioritize energy performance.
- Developing an integrated digital platform to monitor the effectiveness of reconstruction measures.
- Incorporating energy efficiency requirements into national construction norms and standards.

Making conclusions, energy-efficient reconstruction is not merely a technical task, it is a strategic choice for Ukraine's future. It enables resource savings, reduces

energy dependency, mitigates climate impacts, and improves citizen wellbeing. A holistic approach that integrates energy efficiency into all levels of policy and practice is essential for Ukraine's sustainable development and European integration.

REFERENCES

1. *Про внесення змін до деяких законів України щодо врегулювання повноважень центральних органів виконавчої влади у сфері забезпечення енергетичної ефективності*. (2024). Офіційний вебпортал парламенту України. https://zakon.rada.gov.ua/laws/show/3764-20#Text

2. *Деякі питання стратегічного розвитку енергетичної ефективності будівель*. (2023). Офіційний вебпортал парламенту України. https://zakon.rada.gov.ua/laws/show/1228-2023-%D1%80

3. Україна та Німеччина запускають спільний проект з оснащення об'єктів критичної інфраструктури відновлюваними джерелами енергії. (2023). Урядовий портал. https://www.kmu.gov.ua/news/ukraina-ta-nimechchyna-zapuskaiut-spilnyi-proekt-z-osnashchennia-obiektiv-krytychnoi-infrastruktury-vidnovliuvanymy-dzherelamy-enerhii

Виробництво та технології: автоматизація та інноваційні підходи

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AUTOMATION OF LIME ROASTING IN A SHAFT KILN USING MIC-51 MICROCONTROLLER

Automation of industrial processes can increase production effectiveness, reduce costs and improve the quality of products. Lime roasting is one of such processes widely used in industry, where high quality of the final product is of key importance. The use of MIC-51 microcontroller allows to automate and optimize the roasting process in the shaft kiln, reducing the human factor and increasing the stability of the equipment. There are some characteristics of lime roasting in a shaft kiln. The shaft kiln is a vertical structure in which limestone is subjected to thermal treatment, turning it into quicklime. Strict temperature control and maintenance of optimum fuel and air flow rates are required to achieve high-quality firing. Variations in these parameters directly affect the efficiency and final quality of the product. A shaft kiln consists of a shaft, loading and unloading devices and air producing apparatus. Limestone is loaded into the shaft kiln either intermittently or continuously from the top. As the lime is unloaded, the material slides downwards and flue gases flow towards the material [1].

By the nature of the processes occurring in the shaft kiln, three zones are distinguished: heating, roasting and cooling. In the heating zone in the upper part of the kiln with a temperature not exceeding 200℃ limestone is dried, heated, and organic impurities are burned out.

In the middle part of the kiln - in the firing zone, where the temperature reaches 900 - 1200 ℃, there is a decomposition of $CaCO3$ and the emission of carbon dioxide. In the lower part of the kiln, the cooling zone, the lime is cooled by air coming from below from 900 ℃ to 80 - 100 ℃ [1].

The role of microcontroller MIC-51 is to control the technological processes, it was proposed to take the MIC-51 microcontroller as a basis. MIC-51 is a specialized microcontroller designed for controlling technological processes. Its features include built-in functions for working with temperature sensors, power controllers and other components, making it ideal for lime kiln automation [2].

The automation system based on the MIK-51 allows the following:

1. Control the temperature inside the shaft kiln with high accuracy using thermocouples and infrared sensors;
2. Adjust air and fuel supply to maintain optimal combustion conditions;
3. Record and analyze data on temperature changes and fuel consumption to improve process control;
4. React to parameter deviations in a timely manner, preventing overheating or underheating of the material;
5. Benefits of firing automation;
6. Higher end product quality due to stable temperature control;
7. Reduction of fuel consumption due to optimization of resource supply;
8. Lower human factor influence on the firing process, which reduces the probability of errors;
9. Safety: the automatic system reduces the risks associated with high-temperature processes.

In conclusion it is necessary to state that the use of microcontroller MIC-51 for automation of lime roasting in shaft kiln opens up opportunities for significant improvement of production effectiveness and quality. Integration of such automation systems meets modern industrial requirements and contributes to the sustainable development of the enterprise.

REFERENCES

1. *Контролер малоканальний багатофункціональний мікропоцесорний МІК-51. Керівництво по експлуатації*. (2008). Івано-Франківськ.
2. Кривенко, П. В. (2004). Будівельне матеріалознавство: підручник. К. : ТОВ УВПК «ЄксОб».

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MULTIFRACTAL ANALYSIS OF THE INFLUENCE OF CHROMIUM-NICKEL CAST IRON STRUCTURE ON ITS QUALITY CRITERIA

Relevance of the work. The industry makes extensive use of chromium-nickel cast irons because they offer both hardness and wear resistance properties. The material properties strongly rely on the microstructure arrangement of structural components including matrix and carbide phases and their morphology and size distribution. The traditional assessment techniques of metallography and hardness measurements show limited accuracy because cast iron structures present inherent complexity and heterogeneity [1]. The multifractal analysis with its statistical Renyi dimensions spectrum shows better sensitivity and higher correlation coefficients than traditional methods for mechanical property prediction [1, 2]. The research examines how chromium-nickel cast iron microstructure affects its quality criteria through hardness measurements using multifractal analysis while evaluating these findings against conventional structural assessment techniques.

Materials and Methods. The material under examination represents highly alloyed cast iron with total chromium content of about 3% and nickel content of approximately 5%. Standard heat treatment procedures were applied to cast samples to produce various microstructural outcomes. The analysis of samples through optical metallography revealed metastable austenite or martensite matrices alongside uniformly distributed carbides. The HRC scale measured rock hardness to serve as an integral quality standard [3].

The multifractal analysis started by converting digital microstructure images into binary forms followed by carbide phase separation. The box-counting algorithm operated at various scales to determine the multifractal dimension spectrum f(α) which included singularity spectrums represented by α and fractal dimension distributions given by f(α). The analysis computed three general fractal dimensions which included the Hausdorff dimension D_0 and the informational dimension D_1 and the correlation dimension D_2. The analysis of traditional structures involved determining both carbide volume proportions and their mean particle dimensions [4].

Results and Discussion. The metallographic analysis showed that higher carbide content is associated with higher hardness values. The samples with martensitic matrices and high chromium carbide content reached approximately 55 HRC while the samples with austenitic matrices reached approximately 45 HRC. The traditional quantitative parameters (e.g. carbide volume) only partially describe the complexity of microstructural distribution [1].

The multifractal analysis gave more detailed information, showing higher fractal dimension D_0 (~1.85 vs. ~1.65 in less hard samples) and broader f(α) spectra in harder samples. The f(α) spectrum width Δα for harder samples (~0.45) indicated structural heterogeneity compared to softer samples (~0.30). The fractal dimensions were found to have a strong correlation with hardness values ($r \approx 0.92$) compared to traditional carbide volume fractions ($r \approx 0.75$). Multifractal parameters were found to be more sensitive to microstructural changes that affect hardness [2, 4]. The f(α) spectra analysis showed that denser carbide clustering increased the overall hardness, which is in accordance with the literature that shows correlations between fractal parameters and macroscopic properties [5].

Conclusion. The multifractal analysis established quantitative correlations between chromium-nickel cast iron microstructure parameters and hardness. The hardness of the material increased with complex and heterogeneous microstructures which had higher fractal dimensions and broader multifractal spectra. The multifractal analysis showed benefits over traditional methods because it considered the spatial

non-uniformity of phase distributions which resulted in better hardness prediction accuracy. The results demonstrate that multifractal analysis should be used as a reliable tool for structural and quantitative diagnostics and predicting cast iron performance properties.

REFERENCES

1. Hlushkova, D.B., Volchuk, V.M. (2024). Multifractal analysis of the influence of chromium-nickel cast iron structure on its quality criteria. *Problems of Atomic Science and Technology*. N 1(149), 145-153.
2. Hlushkova, D.B., Volchuk. V.M. (2023). Fractal study of the effect of ion plasma coatings on wear resistance. *Functional Materials*., N 3(30), 453-457;
3. Kalinina, N.E., Glushkova, D.B., Voronkov, A.I., Kalinin, V.T. (2019). Influence of nanomodification on structure formation of multicomponent nickel alloys. *Functional Materials*. N 3(26), 514-518.
4. Hayduk, S.V., Hnatenko, O.V., Andreyenko, O.H., Smart, V.V. (2012). Research on structural transformations of heat-resistant nickel alloys under creep conditions. *New materials and technologies in metallurgy and mechanical engineering*. 37-40.
5. Bolshakov, V.I., Vaganov, V.E. (2014). Carbon containing structural and functional coatings. *Bulletin of Prydniprovs'ka State Academy of Civil Engineering and Architecture*. N 10, 34-43.

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DESIGN, OPERATION AND MAINTENANCE OF DRINKING WATER TREATMENT FACILITIES

Water is a fundamental resource for sustaining life on the planet and providing the population with high-quality drinking water is one of the most important tasks of modern times. The increasing anthropogenic impact on water bodies, climate change and growing demand for water resources emphasize the need for implementing effective and reliable water treatment systems.

Relevance of this topic is stipulated by the necessity to improve water treatment technologies to meet the growing requirements for the quality and safety of drinking water.

This paper covers the main stages of design, key technological processes of purification, as well as the specifics of operation and technical maintenance of the facilities.

1. Key Aspects of Design

- Source of Water Supply and Quality of Raw Water: The selection of the water source and determination of the quality of raw water are crucial, as they influence the choice of the purification technology scheme.

- Requirements for Purified Water: The design of treatment facilities must comply with international and national standards for drinking water quality, including adherence to regulations regarding the content of various pollutants.

- Economic and Environmental Factors: Design must consider the economic efficiency of the facilities and their environmental safety to minimize environmental impact.

- Purification Technology Scheme: The study examines the main stages of water purification, such as pre-treatment, coagulation, flocculation, sedimentation, filtration and disinfection. Each stage has its own characteristics and requirements for implementation.

2. Operation and Maintenance

- Proper Operation: Adherence to technological operating regimes of treatment facilities is essential for ensuring their effective and uninterrupted operation.

- Water Quality Control: Continuous monitoring of water quality at different stages of purification allows for timely detection of deviations from standards and taking corrective measures.

- Optimization of Technological Processes: Regular analysis of treatment facility operation enables the optimization of technological processes, reducing energy consumption and increasing purification efficiency.

- Prevention of Emergency Situations: Developing monitoring and prevention systems for emergency situations is crucial for ensuring uninterrupted operation of treatment facilities.

- Waste Management: The study addresses the issue of managing waste generated during water purification to minimize its environmental impact.

3. Innovative Technologies in Drinking Water Purification

- Membrane Technologies: Application of ultrafiltration, microfiltration, nanofiltration and reverse osmosis to improve drinking water quality.

- Adsorption: Use of activated carbon and other adsorbent materials to remove organic pollutants and micro-pollutants.

- Biological Methods: Application of biological filters and other biological processes to remove organic substances and nitrogen.

- Prospective Technologies: Use of nanotechnology, electrochemical methods and other innovative approaches for water purification.

Making conclusions, it is essential to highlight that proper design, operation and maintenance of treatment facilities are critically important for providing the population with high-quality drinking water. It is necessary to continuously improve water purification technologies, optimize operating regimes and implement innovative methods for controlling water quality. This will not only increase purification efficiency but also reduce energy consumption and the environmental impact of water treatment plants.

REFERENCES

1. Vaddiparthi, H., Ma, J., Do Quang, Z., Persson, K. M., Sancho, R., Amengor, J., Breda, I., Ho, Y.-C., Zhao, Y., She, Q. (n. d.) Design, Operation and Maintenance of Drinking Water Treatment Plants. Authors: on behalf of the Specialist Group. 67-71.

2. *In Global Trends & Challenges in Water Science, Research and Management. A compendium of hot topics and features from IWA Specialist Groups*. (2022). Third edition. International Water Association. 174.

3. Water Aid (2019): Functionality of wastewater treatment plants in low- and middle-income countries. Desk review. London: Water Aid.

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AUTOMATED SYSTEM OF OPERATIONAL CONTROL OF HEATING AND AIR CONDITIONING IN BUILDINGS

Human health and working capacity of a person are largely determined by the conditions of the microclimate and air environment in the premises of residential, administrative and public buildings.

The development of systems to ensure the necessary microclimate parameters is a rather complex and responsible task, and comfortable and cozy conditions for a person will completely depend on it. The problem today is the steady increase in energy consumption by these systems due to the rise in the cost of non-renewable energy sources and our task is to model the operation of systems to ensure the necessary microclimate parameters, taking into account changes in the factors that affect it and minimize the use of non-renewable energy sources [2].

The known modeling methods are approximate and have drawbacks that lead to a decrease in accuracy and limit the scope of application. Therefore, one of the ways to obtain effective thermal solutions is to model thermal processes with subsequent analysis of the results.

It is proposed to model the thermal field in a room by an electric field in an electrolytic bath, considering the current density to be analogous to the heat flux density. The shorter the distance between the measurement points, the more accurately the electric and, consequently, the thermal field is reproduced.

However, the method does not take into account all the factors that affect the microclimate of the room. Modeling of radiant heat transfer by an electric field has revealed a significant labor intensity of data entry and results acquisition [2].

To reduce the error of modeling the thermal field in a room by the electrolytic method, two measurement methods have been proposed: the compensation method and a voltmeter with a potential input. The first method involves creating an external potential difference that eliminates the influence of the voltmeter current, ensuring accurate measurements. The second method uses a voltmeter with a high input impedance, which minimizes current consumption and errors [1].

It has been experimentally established that the analog model allows us to study radiant heat transfer without taking into account convection and heat transfer. However, the method has disadvantages: the cumbersomeness of the model and significant time spent on experiments, which makes it difficult to obtain results quickly [4].

The development of controls for indoor climate control systems is becoming increasingly difficult, as the organizational structure of such systems is becoming more complex. With the advent of high-performance electronic computers and virtually unlimited RAM, simulation modeling has become one of the most important tools for analyzing the structure of complex processes and systems [3].

Investigations made by Ukrainian scientists gave the following definition of simulation modeling: “Simulation modeling is the process of constructing a model of a real system and setting up experiments on this model in order to understand the behavior of the system. A model of a real system is a representation of a group of objects or ideas in some form different from its actual embodiment” [1].

Specialized programs and regulatory materials are used in building design. Design documentation is the primary simulation model that is supplemented in construction and operation. It should include the information system that compares real parameters with models, generates recommendations and improves them. Once adapted, the system can be integrated into automated heating and air conditioning control. It is also used to design similar buildings [2].

It is necessary to solve these problems. There are some ways of solving it:

– to describe the behavior of the system (the influence of the microclimate of the external environment, the geometric dimensions of the room, the thermal characteristics of the building envelope, the location of the premises (relative to the cardinal points) and many other factors that affect the microclimate inside the building);

– build theories and hypotheses that can explain the observed behavior;

– use these theories to predict the future behavior of the system, i.e., those factors that may be caused by changes in the system or changes in the way it operates and to automate the system's management [1].

The proposed approach to solving the issues raised will allow us to identify the points of interaction between various elements and factors that affect the microclimate in the premises of buildings for various purposes. In future it is necessary to use the method of simulation modeling to study changes in microclimate parameters in the premises of buildings for various purposes when changing the factors that affect it. It becomes possible to create a system of automatic control of technological processes of heating and air conditioning of premises, which will be adapted to changes in factors that affect the microclimate in the premises of buildings for various purposes.

REFERENCES

1. Бєліков А. С., Петренко В. О., Петренко А. О., Кравчук А. М. (2010). Моделювання та дослідження мікроклімату в приміщенні. Вісник Придніпровської державної академії будівництва та архітектури, (8), 55–60.

2. Петренко, А. О., Петренко, В. О., & Цуканов, А. А. (2016). Автоматизована система оперативного управління опаленням і кондиціонуванням будівель. Вісник Придніпровської державної академії будівництва та архітектури, (8), 51-58.

3. Хапченко, О. В. (2019). Система прийняття рішень для забезпечення теплового комфорту.

4. Чайка, В. А. (2023). Автоматизація процесу керування систем центрального кондиціонування повітря промислового підприємства.

Архітектура та будівництво: сталий розвиток та новітні матеріали

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THE DEMOGRAGHY EFFECT OF MODERN CONSTRUCTION TECHNOLOGIES OF A CITY DURING WARTIME ON THE EXAMPLE OF FACADE FINISHING

Military actions on the territory of Ukraine have significantly affected the population of the country, reducing it not only due to irreversible losses and risks to life. Unfortunately, the population was forced to adapt to these conditions and organizing a changed, but full life. One of the reasons for population outflow is the declining attractiveness of certain areas that are aesthetics and modernity.

Surprisingly, the city of Dnipro has managed not only to maintain but possibly even increase its population. Although official statistics are not currently published, according to Population HUB, the population of Dnipro in 2025 is 984,423, while in 2022 it was 968,502. This happened at the expense of temporarely displaced people, who according to the regional Military Administration is more than 450,000 in the Dnipropetrovsk region. These people represent significant development potential for the region, as they should create acceptable living conditions, which leads to investment in housing and, as a result, into local infrastructure. However, the key challenge is how to retain this additional population in the region, especially, despite sharing similar cultural traits, they are free to choose safer places to live.

One of the key factors is the development of local infrastructure for the full support and well-being of all population groups. In this abstracts, we are focusing on a

relatively new and effective method of decorative facade finishing. In our time of heightened energy-saving demands, facade finishing should be considered only in combination with thermal insulation. This method is a further development of the External Thermal Insulation Composite System (ETICS), which has proven to be highly effective. The design and installation requirements for this technology are thoroughly outlined in various DBNs and DSTUs (Ukrainian building standards). This system has significant advantages over all existing methods of insulation and improving building energy efficiency. The innovation lies in using special decorative techniques that allow for much more appealing textures — resembling wood, stone, brick, or concrete — instead of the well-known and now rather boring options such as “bark beetle” or “pebble dash” finishes.

Why is this necessary and effective? It is indeed possible to decorate facades using natural materials, but such systems have major drawbacks.

It is a well-known fact that wood finishes are not durable when used externally. As a result, government standards do not allow its use for such purposes.

Stone finishing is possible. But durable stone cladding requires a thickness of at least 20 mm, making it heavy and expensive. Although high-quality artificial stones (like porcelain stoneware) exist, their installation requires a ventilated facade system, which is less efficient and also costly.

Cavity wall construction may seem inexpensive, but only when using low-durability ceramic brick. Using high-quality clinker brick significantly raises the cost.

Moreover, achieving a pleasing aesthetic requires expensive adhesives that don't cause efflorescence. This system also faces a fundamental paradox — the greater the weight, the more supporting elements are needed, which reduces insulation or weakens the structure, both undesirable outcomes.

Concrete cladding obviously causes even more problems, such as those mentioned above, due to the weight of the product.

Thus, the use of decorative facade finishing with effects of wood, stone, brick, and concrete — based on classical ETICS — allows for a reliable, cost-effective, and efficient solution. An additional advantage is the optimal application of this technology in renovations where extra load on enclosing structures is undesirable.

Cost calculations and comparisons of various types of insulation and decorative finishes also demonstrate the economic efficiency of this solution. Our calculations demonstrate the following approximate costs per square meter of systems:

Type of Cladding	Wood, Concrete	Cavity Brickwork	Ventilated Facade	Plaster Facade (ETICS)
Cost per sq. m (UAH)	Not permitted by DBN	2700	2800	2500

Based on this, we can conclude that modern construction technologies for facade finishing allow us to achieve a more attractive and modern building appearance without increasing costs. In turn, this contributes to the city's attractiveness for living and helps curb the population outflow.

REFERENCES

1. *Population of Ukraine*. (n.d.) https://population-hub.com/en/population-of-ukraine.html
2. *Державна служба статистики України*. (n.d.) https://www.ukrstat.gov.ua/operativ/menu/menu_u/demografic.htm
3. DBN B.2.6-31:2016. (2016). Thermal insulation of buildings
4. DBN B.2.6-31:2021 (2021). Thermal insulation and energy efficiency of buildings
5. DBN B.2.6-33:2018 (2018). External wall structures with facade insulation. Design requirements.
6. DSTU B V.2.6-36:2008 (2008). Building structures. External wall structures with facade insulation and plaster finishing. General technical conditions.

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BACTERIAL SELF-HEALING CONCRETE

Cracks in concrete are a common problem that negatively affects the durability and performance characteristics of building structures. Traditional repair methods often require significant costs and do not always yield the desired result. Bacterial self-healing is an innovative and environmentally friendly approach that utilizes microorganisms to independently seal cracks, and helps to increase the stability and extension of the service life of concrete structures [1].

This technology is based on the ability of certain bacteria, mainly from the Bacillus and Sporosarcina genera, to perform biomineralization, specifically the precipitation of calcium carbonate ($CaCO_3$). These bacteria are introduced into the concrete mix, often in an encapsulated form for protection. When cracks are formed in the concrete and water penetrates, the bacteria are activated. Utilizing nutrients, which can be pre-mixed into the concrete or generated through the metabolism of cementitious materials, they initiate biochemical reactions. These reactions lead to the formation of carbonate ions (CO_3^{2-}), which then interact with calcium ions (Ca^{2+}) present in the concrete to precipitate as calcite crystals, effectively filling and sealing the cracks [2]. The primary metabolic pathways include ureolytic hydrolysis of urea and microbially induced calcium carbonate precipitation (MICP) utilizing organic acids.

Bacterial self-healing concrete offers numerous significant advantages, making this technology promising for increasing the durability and sustainability of building structures. One of the primary benefits is its capacity for autonomous self-healing: the

process of crack repair occurs without the need for external intervention, which reduces labor costs and operational expenses.

The environmental friendliness of this method is a significant advantage, as it relies on natural biological processes and minimizes the environmental impact compared to traditional repair technologies. Bacterial self-healing also increases the durability of concrete structures by preventing the further development of cracks and protecting reinforcement from corrosion, which significantly extends their service life. This, in turn, reduces maintenance costs, as the need for regular inspections and repairs decreases. The healing of cracks improves the waterproofing of concrete, preventing the penetration of water and aggressive substances, which is especially important for structures located in humid or aggressive environments. Furthermore, bacteria are able to seal microcracks, which traditional repair compounds penetrate with difficultly [3]. Ultimately, this leads to an increase in the service life of concrete structures.

Research shows that bacterial self-healing is effective in healing cracks up to several hundred micrometers wide [3]. Successful results have been obtained both in laboratory conditions and in limited field tests on various concrete structures. The effectiveness often depends on such factors as the type of bacteria used, the availability of nutrients, the crack width and the environmental conditions. While laboratory results are promising, ongoing research continues to explore and optimize the application of bacterial self-healing in real-world construction scenarios to ensure consistent and reliable performance across different conditions and larger structural elements.

Future research will focus on the following directions:

- Searching for more resistant and effective bacterial strains;
- Improving encapsulation methods;
- Optimizing the composition of concrete mixes;
- Combining with other self-healing technologies;
- Conducting large-scale tests and developing standards;

Bacterial self-healing concrete is an innovative and sustainable method that contributes to increasing the lifespan and reliability of concrete structures [4]. Despite

some limitations, active research and development are opening up the significant opportunities for the application of this technology in the construction of the future.

REFERENCES

1. Siddique, R., & Aggarwal, P. (2019). Self-healing concrete: a review on materials and techniques. Construction and Building Materials, 201, 286-304.
2. Jonkers, H. M., Thijssen, A., Muyzer, G., Copuroglu, O., & Schlangen, E. (2010). Application of bacteria as self-healing agent for the development of sustainable durable concrete. Ecological Engineering, 36(3), 230-235.
3. Wang, J., Snoeck, D., Van Tittelboom, K., De Belie, N., & Verstraete, W. (2014). Application of microorganisms for self-healing concrete. Cement and Concrete Composites, 53, 247-267.
4. https://www.sciencedirect.com/science/article/abs/pii/S0925857409000202

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SUSTAINABLE AND ECO-FRENDLY CONSTRUCTION MATERIALS

The growing global focus on sustainability necessitates a critical re-evaluation of traditional building practices and materials. Among the promising eco-friendly alternatives, bamboo stands out as a rapidly renewable resource with a remarkable combination of strength, versatility, and minimal environmental impact. Its rapid growth cycle, coupled with its impressive physical properties, positions bamboo as a significant contributor to a greener future for the construction industry. It is important to explore the key benefits of bamboo as a sustainable building material, highlighting its environmental advantages, structural capabilities, diverse applications, and the potential for its wider adoption in contemporary construction.

Bamboo's rapid growth rate is a cornerstone of its sustainability. Many species can achieve full maturity within three to five years, a stark contrast to the decades

required for conventional timber. This quick regeneration ensures a continuous supply, reducing pressure on forests and mitigating deforestation. Furthermore, bamboo cultivation typically requires significantly less water and avoids the need for synthetic pesticides and fertilizers, promoting healthier soil and ecosystems. Its ability to thrive in diverse climates and even on degraded land further enhances its potential as a locally sourced and environmentally sound material [1].

Beyond its renewability, bamboo possesses exceptional physical properties. Its high tensile strength, comparable to some steel alloys, combined with its lightweight nature and elasticity, makes it highly resistant to seismic activity and strong winds. This strength-to-weight ratio allows for the construction of lighter structures, reducing the need for extensive foundations and lowering transportation costs [2]. Bamboo also exhibits considerable compressive strength, making it suitable for load-bearing applications. Its inherent hollow structure provides natural insulation, contributing to energy efficiency in buildings by reducing heat transfer.

The environmental advantages of utilizing bamboo extend beyond sustainable harvesting. As a fast-growing plant, bamboo sequesters significant amounts of carbon dioxide from the atmosphere, acting as a natural carbon sink and helping to combat climate change. The embodied energy and carbon footprint associated with bamboo production are considerably lower than those of energy-intensive materials like steel and concrete. Minimal processing requirements and the generation of less waste further contribute to its environmental appeal [3].

Making conclusions, bamboo's versatility allows for a wide array of applications in construction, from structural elements like framing and scaffolding to finishing materials such as flooring, wall panels, and roofing. Innovations in engineered bamboo products, such as laminated bamboo lumber and bamboo composites, are expanding its potential for use in modern, high-performance buildings. While challenges related to standardization, durability (requiring proper treatment), and awareness still exist, the growing recognition of bamboo's sustainable attributes and ongoing technological

advancements are paving the way for its increased integration into the global construction landscape.

REFERENCES

1. Kaminski, S., Lawrence, A., Trujillo, D., & King, G. (2016). Bamboo in construction: Towards a sustainable future. ICE Publishing.
2. Van der Lugt, P., Durán, A. H., & Malagamba, L. (2017). Designing with bamboo: The complete guide. Birkhaüser.
3.Yusuf, Y. O., Adefemi, A. T., & Bello, O. O. (2017). Bamboo as a sustainable building material: A review. Journal of Green Building, 12(3), 1-19.

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TRANSFORMATION OF ECONOMIC SECURITY IN THE CONSTRUCTION SECTOR UNDER CONDITIONS OF DIGITAL DEVELOPMENT

The transformation of economic security in the construction sector in the digital era is a complex, multi-level process that affects every aspect of the industry—from planning and project management to supply chains, labor, investment climate, and regulatory compliance. As construction companies increasingly embrace digitalization, their traditional approaches to economic security must evolve to address not only conventional financial and operational risks, but also a wide array of digital vulnerabilities, technological dependencies, and systemic shifts brought about by the Fourth Industrial Revolution.

This digital shift is characterized by growing reliance on an ecosystem of interconnected technologies, including Building Information Modeling (BIM), digital

twins, cloud-based resource management systems, IoT-enabled construction equipment, AI-driven project analytics, and blockchain-based contract verification. These tools enhance operational efficiency by enabling predictive decision-making, facilitating real-time collaboration, and automating resource allocation across diverse and geographically dispersed projects. Real-time budget tracking, cost optimization, logistics planning, equipment maintenance forecasting, and remote quality control are all increasingly managed through digital platforms. As a result, the digitalization of construction contributes to stronger economic performance, greater transparency, and more accurate financial projections at both the project and organizational level.

However, these innovations bring with them a new generation of risks that directly affect economic security. Cyberattacks, unauthorized data access, manipulation of digital records, phishing schemes targeting financial departments, ransomware attacks, and cloud service failures can all compromise operational continuity and threaten the financial integrity of construction firms. For example, a coordinated cyberattack on a cloud-based project management system could paralyze multiple projects simultaneously, delay critical contract deadlines, and result in significant financial penalties or legal liabilities. Additionally, the risk of intellectual property theft—such as unauthorized access to proprietary blueprints or cost databases—has become a pressing concern in an industry where competition is often driven by innovation and design efficiency.

In this context, economic security in the construction industry increasingly depends on a company's cybersecurity posture and digital resilience. Firms must implement multi-layered security architectures, perform regular vulnerability assessments, ensure data backup and recovery protocols, and foster a culture of digital risk awareness among employees. Integrating cybersecurity policies with broader economic risk strategies allows firms to address both digital and financial threats in a cohesive and proactive manner.

Moreover, digital transparency is fundamentally reshaping business competition and investor behavior in the sector. With operational data becoming more accessible

through open-source databases, project dashboards, and cloud reporting tools, construction firms are under increasing pressure to ensure the accuracy, security, and compliance of their financial and technical information. Transparency demands accountability: any inconsistencies or data breaches can undermine investor confidence, disrupt credit lines, and damage a company's long-term market position. In this regard, blockchain technology holds promise for improving trust, automating contract execution, and enhancing the traceability of financial transactions across the supply chain. While still emerging in construction, blockchain-based systems may soon become an industry norm for managing payments, verifying supplier credentials, and reducing the risk of fraud in large-scale, multi-party projects.

Another key element of this transformation involves the evolving nature of labor and management competencies. Economic security is no longer the exclusive domain of financial controllers or procurement officers—it now requires cross-functional expertise that spans digital infrastructure, data analysis, and information security. Project managers and site supervisors must be trained to identify digital threats, follow cybersecurity protocols, and make economically informed decisions based on real-time analytics. Digital literacy, therefore, is becoming a prerequisite for all levels of the construction workforce. Moreover, organizations are increasingly investing in upskilling programs and strategic HR planning to build internal capacity in digital risk management.

At the macroeconomic level, governments and regulatory bodies are responding to this digital evolution by updating national strategies to reflect the interconnected nature of digital and economic risks. In Ukraine, for instance, the National Cybersecurity Strategy emphasizes the protection of critical infrastructure—including construction—as part of the broader economic security system. Internationally, the harmonization of regulatory frameworks with EU digital safety standards, the implementation of ISO/IEC 27000 family standards for information security management, and participation in transnational cybersecurity alliances are critical steps toward building economic resilience in the construction sector.

Digital transformation also necessitates the development of adaptive and resilient business models. Construction companies must not only digitalize their operations but also reconfigure their organizational structures and risk management frameworks to handle the volatility and complexity of a tech-driven marketplace. This includes the diversification of suppliers to reduce dependency on single-source inputs, the acquisition of digital risk insurance to protect against potential financial disruptions, and strategic investments in modular and smart infrastructure capable of adjusting to changing demands. Firms that integrate digital risk assessments into financial planning processes, model cost scenarios using predictive analytics, and leverage digital twins for lifecycle investment planning will be better positioned to absorb shocks and maintain stability during times of economic or technological upheaval.

Conclusions

The transformation of economic security in the construction sector under digital development conditions necessitates a comprehensive, adaptive approach. Digital tools can significantly enhance risk management and economic stability, but they also require new safeguards and competencies. A coordinated effort between business, government, and academia is key to ensuring that digitalization strengthens—not undermines—the economic security of the construction industry.

REFERENCES

1. ISO/IEC 27001:2022. (2022). Information security, cybersecurity and privacy protection — Information security management systems.
2. *BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers*. (2021). Wiley Online Library.
3. Digital Transitions and Innovation in Construction Value Chains, 2023
4. Digital Transformation of the Design, Construction and Management Processes of the Built Environment, 2019

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EXHIBITION CENTER IN DNIPRO CITY

An exhibition center is a specialized building or complex of buildings designed to hold exhibitions, fairs, conferences, presentations and other public events. It plays an important role in the development of the economy, science, culture and education, providing a platform for exchanging experience, establishing business contacts and popularizing achievements.

Typology of exhibition centers:

- *International:* designed to hold large-scale international exhibitions that attract participants from all over the world.
- *National:* focused on holding national-scale exhibitions that demonstrate the country's achievements in various industries.
- *Regional:* designed to hold regional-scale exhibitions that showcase the achievements of the region.
- *Local:* focused on holding local exhibitions that showcase the achievements of the city or district.

Exhibitions can be divided according to the specialization: *Universal:* designed for holding exhibitions of various themes; *Specialized:* focused on holding exhibitions of a specific theme (for example, industrial, agricultural, art).

Exhibition classification:

- *Regional exhibitions* have a radius of action of up to 100 km, represent one or more industries and are designed to demonstrate the capabilities of small businesses.

- *Interregional exhibitions* have the same structure, but a larger radius of action and attract more businesses.
- *National exhibitions* are a kind of showcase of national industry, held in the country or abroad with the aim of demonstrating nationally produced products and stimulating their sales, and are of an inter-industry nature.
- *International exhibitions* are once where exhibitions from foreign countries participate, and it should be at least 10-15% of the total number of participants.

According to the areas of work, the exhibitions are distinguished: trade shows where goods are sold or orders are received; informative exhibitions; exhibitions held to develop communications and establish contacts.

Some types of innovation in transformation of premises.

1. Flexible and modular spaces - Modern exhibition centers and conference halls are equipped with mobile partitions that allow you to change the configuration of the room.

2. Robotic and intelligent systems - Sliding walls and ceilings, lifting stages and screens, interactive panels to change the design and functionality of the walls.

3. Transforming furniture - Tables, chairs and racks that can be folded, changed in height and transformed into other pieces of furniture. This allows you to quickly adapt the space to specific tasks.

4. AR-VR solutions - Projection technologies allow you to change the visual design of walls and ceilings without physical reconstruction. VR zones create interactive expositions without the need to use physical equipment.

5. Environmentally friendly and energy efficient solutions - Recyclable materials for partitions and walls. LED lighting with adjustable intensity. Smart ventilation and heating systems that adapt to the number of people in the room.

Why does Ukraine need exhibition centers today?

In today's conditions, exhibition centers in Ukraine play an important role in supporting and developing various sectors of the economy, as well as in promoting international cooperation. Here are some key aspects:

1. Economic development: *trade promotion* – a platform for meeting investors, business partners, etc. to conclude agreements and expand the market; *investment attraction* – demonstration of Ukrainian enterprises to attract foreign investors; *support for small and medium-sized businesses* – presentation of products and services; *tourism development* – international exhibitions - increase in tourists.

2. International cooperation: *demonstration of Ukraine's achievements* in various industries; *exchange of experience* – between Ukrainian and foreign specialists; *establishment of business contacts* – a meeting place for business representatives from different countries.

3. Science and education: *popularization of science*; *educational events*; *demonstration of innovations* – latest developments and technologies.

4. Culture and art: *holding cultural events* – art exhibitions, concerts, festivals, etc.; *popularization of Ukrainian culture*

Conclussion: As research shows, exhibition centres in Ukraine remain an important element of infrastructure, contributing to the development of the economy, culture and international cooperation, especially in the context of European integration and post-war reconstruction.

REFERENCES

1. Cabinet of Ministers of Ukraine, (2003). Concept for the development of exhibition activities.

2. DBN. V.2.2-16-2019 Cultural, entertainment and leisure establishments.

3. Kolosova, N.A., Osadcha, E.O. (2021). Historical prerequisites of exhibition activities.

4. Kravchenko, O.M., Bukoros, E.O. (2021). Analysis of the possibilities of using exhibition activities by manufacturing enterprises of Ukraine to promote products in international markets.

5. Simonchuk, O. (2019). How modern technologies change art.

6. Tkachenko, T.I., Duplyak, T.P. (2016). Kyiv, “Exhibition business”.

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ENSURING THE SAFETY OF BUILDINGS AND STRUCTURES CONSIDERING THE CONSEQUENCES OF FIRES AND EXPLOSIONS

Ensuring the safety of buildings and structures in the face of fire and explosion risks requires an integrated approach that combines careful design, adherence to regulatory standards, rigorous testing of materials, and the implementation of robust operational procedures. Fires and explosions pose unique challenges: fires can develop gradually or suddenly depending on fuel sources, and explosions often have immediate, high-impact consequences that can compromise the integrity of even well-designed structures.

A critical step in addressing these risks is comprehensive risk assessment, which involves identifying possible ignition sources, flammable materials, and potential explosion scenarios. Engineers and safety specialists typically classify hazards based on their likelihood (probability) and severity (potential damage and casualties). This enables the development of a structured plan that targets the most significant threats. In many countries, including Ukraine, this process is guided by a combination of local regulations and international standards, such as the Eurocodes (e.g., EN 1991-1-2 for fire and EN 1991-1-7 for accidental actions including explosions), which provide principles for designing structures to withstand extreme conditions. Structural fire protection is one of the major pillars of building safety. It includes:

1. Passive fire protection—elements embedded in the building's structure, such as fire-resistant walls, ceilings, and floors, along with intumescent coatings and fireproofing materials that slow the spread of fire and reduce the rate at which structural members heat up.

2. Active fire protection—systems designed to detect and combat fires in their early stages, including automatic sprinklers, fire extinguishers, and alarm systems that facilitate a timely evacuation. These systems, coupled with robust compartmentalization (fire barriers that section off the building), can drastically reduce the risk of a single fire spreading throughout the entire facility.

When evaluating explosion risks, engineers must consider both internal and external sources:

- Internal explosions might stem from the accidental release of flammable gases or dust clouds within confined spaces, causing sudden pressure surges that push outward on structural elements.
- External explosions can result from industrial accidents, terrorist acts, or explosions in nearby buildings or facilities, generating shock waves that travel through open space before impacting the target structure.

Design strategies against explosions generally involve:

- Load-spreading and redundancy: By ensuring multiple load paths and robust structural continuity, the building is less likely to suffer disproportionate collapse from local damage.
- Energy absorption: Materials such as steel and reinforced concrete can be detailed to undergo controlled plastic deformations, thereby absorbing some of the energy from an explosion.
- Ventilation and pressure relief: Where feasible, “sacrificial” panels or blow-out walls can be installed to direct explosive forces away from critical structural elements.

In addition, modern construction practices often leverage computational modeling to simulate fire and explosion scenarios under different conditions. Advanced finite element analysis tools can predict temperature distribution, stress/strain behavior, and structural damage, facilitating the optimization of protective measures. Performance-based design methods allow engineers to propose innovative solutions

that satisfy safety objectives while accommodating the architectural vision or functional requirements of a building.

Operational measures are equally vital for maintaining safety across a building's lifespan. This entails:

- Routine inspections to check the integrity of fireproof coatings, corrosion protection, and any damage from everyday use or minor incidents.
- Staff training and drills to ensure occupants can respond effectively to alarms, use firefighting equipment appropriately, and follow evacuation routes under stressful conditions.
- Continuous monitoring systems (sensors, alarms, and automated controls) that detect anomalies in temperature, pressure, or structural vibrations, allowing for rapid intervention.

Finally, emergency planning and post-incident evaluation play a crucial role in mitigating the impact of fires and explosions. Properly established evacuation routes and procedures can drastically reduce the risk of injury or death, and thorough investigations of near-misses or actual incidents can yield vital lessons that refine future safety measures. By combining advanced design techniques, adherence to relevant codes, strategic material selection, and ongoing oversight, stakeholders can significantly lower the probability of catastrophic failure, ensuring that buildings remain resilient and occupants remain protected in extreme events.

Conclusions

Ensuring the safety of buildings and structures with regard to the risks of fires and explosions demands a comprehensive approach, starting from the earliest stages of design and continuing through competent operation. In Ukrainian practice, alongside national standards, there is a growing emphasis on European norms (Eurocodes) and international experience. Adhering to modern regulations, employing proven fire protection technologies, and properly allocating resources for risk management can substantially reduce the likelihood of catastrophic outcomes and enhance the resilience of buildings under extreme conditions.

REFERENCES

1. EN 1992-1-2:2004 Eurocode 2. Design of Concrete Structures – Part 1-2: General Rules – Structural Fire Design. Brussels: European Committee for Standardization (CEN), 2004.
2. EN 1993-1-2:2005 Eurocode 3. Design of Steel Structures – Part 1-2: General Rules – Structural Fire Design. Brussels: European Committee for Standardization (CEN), 2005.
3. European Convention for Constructional Steelwork (ECCS). Publications on Fire Engineering. Brussels, ECCS.
4. SFPE Handbook of Fire Protection Engineering. 5th Edition. Society of Fire Protection Engineers, 2016.
5. ASCE/SEI 59-11 Blast Protection of Buildings. Reston, VA: American Society of Civil Engineers, 2011.
6. NFPA 5000: Building Construction and Safety Code. Quincy, MA: National Fire Protection Association, 2021.

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CONCRETES WITH ACTIVE RECYCLED AGGREGATES

In the construction industry, concrete is one of the most common materials. Its versatility, strength, and relative affordability have led to its widespread use in infrastructure projects and civil construction. However, the high demand for concrete leads to significant consumption of natural resources, particularly sand, gravel, and crushed stone, which are the main components of aggregates. The extraction of these natural aggregates is associated with a number of environmental problems, including the depletion of natural resources, the destruction of ecosystems, and landscape alteration.

In parallel with the growth of concrete production, the volume of construction waste is increasing, which constitutes a significant portion of the total volume of solid

waste sent to landfills. In response to these challenges, the concept of sustainable construction is gaining increasing relevance. Sustainable construction involves the use of materials and technologies that minimize the negative impact on the environment throughout the entire life cycle of a building or structure.

Due to the large-scale destruction caused by the russian invasion, the problem has significantly worsened. As of March 2025, the Ukrainian Register of Damaged and Destroyed Property (URDDP), which records information about destroyed objects, contained 231,000 residential buildings.

Unfortunately, the number of destroyed buildings is growing daily, and along with it, the volume of generated construction waste is increasing. The problem of disposal and recycling of these huge volumes is one of the serious challenges for the future reconstruction of Ukraine.

Recycled construction waste, such as concrete, brick, ceramics, and glass, is a source of recycled aggregates [1]. However, without proper sorting and processing, their quality is usually inferior to primary natural counterparts, which limits their scope of application [2]. An evolutionary step towards expanding the scope of application and improving the quality characteristics of the final product was the rethinking of the role of aggregates – from passive inertness to active participation. New generation recycled aggregates, called “active” aggregates, not only fill the concrete matrix but also enter into chemical and physical reactions within it. Their activity is mainly due to hydration processes and pozzolanic reactions.

Some recycled materials, such as finely ground waste glass, exhibit pozzolanic properties. Pozzolans react with calcium hydroxide, a byproduct of cement hydration, forming additional cementitious compounds (calcium silicate hydrate or C-S-H), which helps to increase the strength and durability of concrete [3].

The presence of active recycled aggregates, especially recycled concrete aggregate (RCA) with adhered mortar, can affect the microstructure of the cement stone and the interfacial transition zone (ITZ) between the aggregate and the mortar. The ITZ in concretes with RCA is often weaker and more porous due to the old mortar

[2]. However, internal curing and pozzolanic activity can contribute to the densification and strengthening of this zone.

The high water absorption of recycled aggregates, which was previously seen as an obstacle to convenient placement, opens up the possibility of providing internal curing of concrete. This emphasizes the importance of careful analysis of the water absorption and desorption characteristics of a specific recycled aggregate when designing a concrete mix. The use of pozzolanic recycled aggregates is not only an environmentally friendly solution for waste disposal but also a promising way to improve the performance properties of concrete. For the full realization of their pozzolanic potential, processing technologies, particularly fine grinding, are crucial. Given the critical role of the ITZ in the formation of the quality characteristics of concrete, further research should focus on its optimization in concretes with active recycled aggregates (through pre-treatment or the use of active admixtures), which is extremely important for the wider implementation of these materials in building structures.

CONCLUSIONS

The use of active recycled aggregates has significant environmental and economic benefits but is associated with certain technical challenges. A careful approach to the selection, processing, and application of these materials is key to their successful use in the construction industry.

REFERENCES

1. Morkovska, N. H., Abdelrahem, A. (2019) Processing of construction waste generated in Ukraine. Municipal Economy of Cities. Vol. 1, No. 147. 210–213.

2. Savytskyi, M., Smyrnov, A. (2024). Properties of secondary coarse aggregates obtained from crushing concrete waste. *Building Structures. Theory and Practice*, (14).

3. Lima, C., et al. (2013). Physical properties and mechanical behaviour of concrete made with recycled aggregates and fly ash. *Construction and Building Materials*, 47: 547-559.

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UNMANNED AERIAL VEHICLES IN LAND SURVEYING

Unmanned aerial vehicles (UAVs) or drones have now become an essential component of surveying as they can capture accurate and instant aerial photographs. Sophisticated drones possess high-resolution cameras and laser scanners that allow them to create three-dimensional models of landscapes, scan extensive areas and monitor buildings and structures. Among the main advantages of drone technology in geodesy is that they can reach remote, hard-to-reach areas, such as mountain or forest areas, where traditional measurement methods are limited. Drones avoid endangering employees as they never have to be in perilous or out-of-reach locations.

Using UAVs in surveying enhances the capabilities of surveyors and simplifies their activities. They are used for:

1. Aerial Photogrammetry and Mapping. Equipped with high-resolution cameras and LiDAR sensors, UAVs can capture high-resolution images that are processed into orthophotos, 3D terrain models, and digital elevation models. Compared to traditional ground surveys, UAV-based photogrammetry saves significant time and cost of data acquisition with high accuracy.

2. Monitoring Land and Infrastructure. Drones are widely used for infrastructure object and road network monitoring as well as monitoring construction. They provide frequent and accurate reports about land development, allowing engineers and urban planners to make decisions.

3. Land Management and Precision Agriculture. Multispectral and thermal sensors aid in the monitoring of soil health, vegetation density, and water distribution.

Environment specialists and farmers utilize this to optimize land usage and increase yield.

4. Environmental Monitoring and Disaster Assessment. UAVs help in damage estimation following a calamity by swiftly surveying and providing accurate geospatial data.

A UAV for geodetic surveying should have a number of characteristics:

– a powerful battery that will allow the UAV to stay in the air for a long time without the need to recharge;

– a camera with good resolution and good signal transmission power, as the drone must climb to a given height and remain controllable;

– the ability to perform thermal imaging of an object is an extremely handy feature, especially useful when checking roofs or industrial buildings;

– introduction of laser scanners that can detect objects hidden by dense vegetation.

Compared to traditional geodetic surveys, surveys carried out based on UAVs have many advantages, including efficiency, cost-effectiveness, safety, high-resolution information. Day by day, the use of UAVs in geodesy will increase even more, helping even more with land surveying and environmental monitoring.

REFERENCES

1. Геодезичні квадрокоптери. (2024). Retrieved from https://wondertech.ua/ua/drones/geodezicheskie-kvadrokoptery (Accessed at 12.04.2025)

2. Фоменко, В. (2024). Технології дронів у геодезії: перспективи та виклики. *Наука і Техніка Сьогодні*, 9(37). 918-930. https://doi.org/10.52058/2786-6025-2024-9(37)

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LES BÂTIMENTS BIOPOSITIFS ET LEURS PERSPECTIVES DANS LA RECONSTRUCTION DES VILLES UKRAINIENNES

La tendance à créer des logements écologiques et confortables est apparue dès les années 1970. À la suite de la crise pétrolière de 1973, les sociétés occidentales, notamment aux États-Unis et en Europe, se sont tournées vers des sources d'énergie alternatives, favorisant ainsi l'éveil d'une conscience écologique. Cette évolution a marqué l'émergence des premières caractéristiques de l'architecture biopositive dans le secteur du bâtiment. Par la suite, la croissance de l'industrialisation et de l'urbanisation a entraîné des changements climatiques constants, aboutissant aujourd'hui à une crise écologique mondiale. En réponse à cela, les architectes contemporains privilégient de plus en plus la construction de bâtiments écologiques afin de limiter l'impact environnemental du secteur.

Comparés aux bâtiments résidentiels classiques, les bâtiments biopositifs présentent de nombreuses différences, bien qu'ils partagent certains principes fondamentaux, tels que l'ensoleillement naturel et la ventilation. L'orientation optimale du bâtiment est essentielle pour maximiser l'entrée de lumière et d'air frais, réduisant ainsi la dépendance à l'éclairage artificiel et à la climatisation.

Une attention particulière est accordée à l'utilisation de matériaux organiques, exempts de substances toxiques, garantissant ainsi un environnement sain. L'un des avantages majeurs de l'architecture biopositive réside dans son usage efficace des ressources naturelles : intégration de panneaux solaires dans les toits et les façades,

collecte des eaux de pluie pour l'irrigation des toits et des façades végétalisés, et isolation thermique par des poches de terre.

Le principe fondamental de la biopositivité repose sur la préservation du paysage naturel et la réduction au minimum de l'empreinte humaine sur l'écosystème. Ces constructions améliorent la qualité de vie et constituent une clé pour résoudre de nombreux problèmes environnementaux. Elles agissent comme des purificateurs d'air, ont un effet positif sur la thermorégulation de la ville, c'est-à-dire qu'elles empêchent l'apparition d'îlots de chaleur, et réduisent le stress des habitants grâce au contact constant avec la nature.

Aujourd'hui, l'architecture verte est en pleine expansion en Europe, en Scandinavie, en Amérique et en Australie. En Ukraine, les bâtiments biopositifs ne sont pas encore largement répandus, mais certains projets réalisés à Kiev et à Kharkiv répondent déjà aux standards écologiques internationaux.

À la suite de l'invasion à grande échelle de l'Ukraine, les statistiques de 2024 indiquent que 340 000 bâtiments ont été détruits, dont 250 000 résidentiels. Certaines villes ont été complètement rasées, et la qualité de l'air se détériore en raison des incendies et de l'utilisation massive d'armements. La guerre a laissé des séquelles profondes, tant psychologiques que physiques, sur la population. Les architectes ont désormais pour mission de reconstruire un habitat non seulement fonctionnel, mais aussi porteur de bien-être moral. À cet égard, l'architecture biopositive constitue une réponse idéale.

Les urbanistes ukrainiens développent également le concept de quartiers et de villes écologiques. En été 2024, certaines régions du sud de l'Ukraine ont enregistré des températures record de 39 à 41 °C. En raison du réchauffement climatique, les « jungles de béton » deviennent des pièges thermiques pour les citadins. Les villes écologiques, grâce à leur végétation abondante et à la purification naturelle de l'air, pourraient offrir un refuge pendant ces périodes de canicule extrême.

Conclusion. L'avenir de l'architecture biopositive est prometteur, non seulement à l'étranger, mais aussi en Ukraine. Les maisons écologiques représentent une tendance

en forte croissance à l'échelle mondiale. Avec l'éveil de la conscience écologique, les villes du futur seront vertes plutôt qu'hyper-industrielles. Pour le peuple ukrainien, qui traverse actuellement une période difficile, l'habitat biopositif pourra devenir un véritable « havre de paix » et un outil de réhabilitation psychologique après le conflit.

RÉFÉRENCES

1. Leontiev D. V. (2010). Architecture de l'Ukraine. Grande encyclopédie illustrée, Kharkiv.
2. Article scientifique: «Développement du concept d'«architecture verte» dans le design moderne».
3. Article: «Architecture verte pour les centres de bureaux: comment les centres d'affaires ukrainiens peuvent tirer parti de la tendance verte».

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IMPROVISED EDUCATIONAL ENVIRONMENTS: HOW ARCHITECTURE HELPS TO LEARN DURING THE WAR

Actuality. Architecture is changing under the influence of time. Adaptation of the environment, especially infrastructure, plays a fundamental role in people's lifes. The relevance of architecture, its functionality helps to organize space better and has a sense of security. In times of war, educational institutions should be safe places to be, guaranteeing not only quality education, but also safety and convenience.

Aim. The aim of the research is to show how educational institutions have changed and adapted over time to make learning process safer for children.

Outline of the main material. Educational institutions should be a lifesaver, providing a space where children can be protected from threats. The Safe Schools Declaration was opened for state endorsement in Oslo, Norway, in May 2015. It is a

political commitment to better protect students, teachers, schools and universities during armed conflict, to support the continuation of education during war, and to put in place concrete measures to deter the military use of schools. Today, 120 States have endorsed the Safe Schools Declaration. By endorsing the Declaration, States commit to restoring access to safe education and to developing education systems that are conflict-sensitive and promote respect between social or ethnic groups. The Declaration is a framework for collaboration and exchange, and endorsing countries meet on a regular basis to review implementation of the Declaration [1].

After the Second World War, cities needed a quick, modern approach to rebuild big areas in a short amount of time; many people were homeless, services were destroyed. The result was a rejection the several past styles, and creating a new feature, which would be more relevant. The two photographs below illustrate how schools for young children have evolved over the 60 years, with each one reflecting the typical architecture of its era[3]. School design changed significantly. Post-war schools required more space overall, as they had to accommodate more students and various activities. These schools also needed individual spaces of different sizes and shapes for different purposes, from quiet, clean tasks to noisier, messier ones. The design of these schools was made adaptable to future changes, allowing flexibility in how spaces could be used.


Photo. 1. The school built nearly 1900s

Photo. 2. The school built in 1945-50s

In today's context, during the full-scale invasion of Ukraine, the importance of adaptable and resilient school design has become even more evident. These approaches in creating engaging environments highlight how architecture responds to both societal needs and external challenges.

According to the Ministry of Education and Science, over 200 schools have been destroyed in Ukraine due to enemy strikes, and 1,600 have been damaged. As a result, nearly 900,000 children have to study remotely. One of the examples of rebuilding and rethinking the way of creating schools was proposed by IK-architects. Their projects focused on renovating educational institutions in Kharkiv, and one of them is VILNA school (Ph. 3),[4]. The modular system, which they made in this project, provides the flexible and safe space, allowing modules joining each other, creating bigger blocks for sports or recreational area, and smaller for administrative purposes. Not depending on only one function of the building, it is possible to change or delete the blocks, change the functions or the size of rooms.

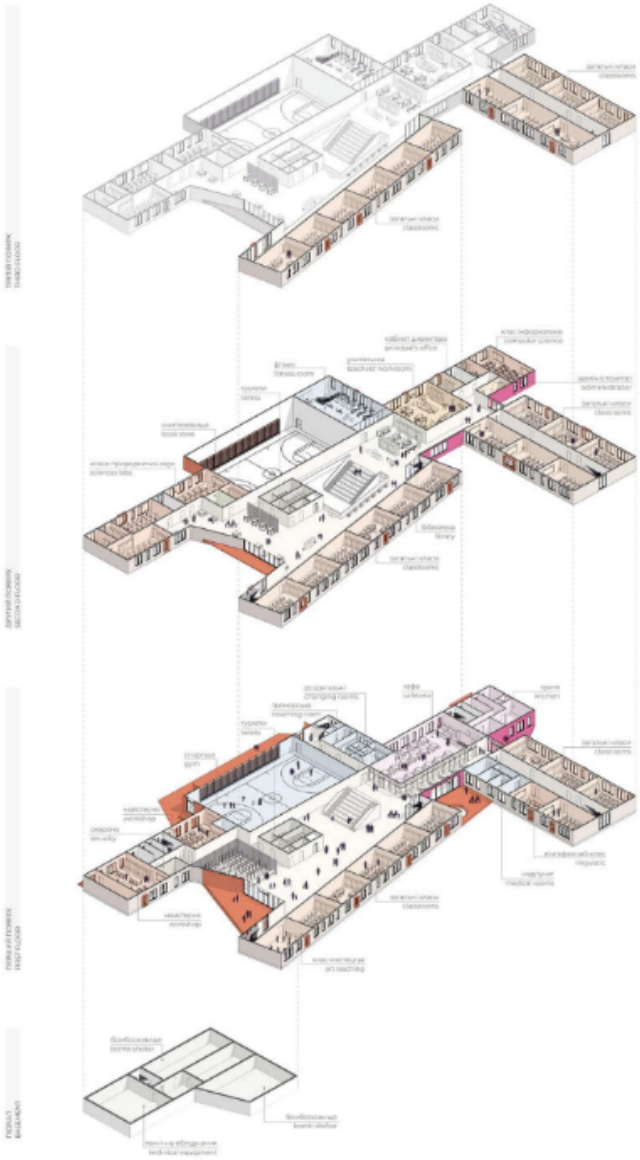

Photo. 3. The functional plan of the school

In July, the Ministry of Digital Transformation, the Ministry of Education and Science, the NGO “Mariupol Reborn,” and Big City Lab signed an agreement to develop a concept for the architectural transformation of schools. This partnership enabled the launch of a pilot project to renovate five standard schools, adapting them to the needs and challenges of the new circumstances [6].

“Everyone says we need to build back better. But what does 'better' really mean? We surveyed over five hundred educators, students, and education experts to develop the principles for rebuilding and to set tasks for architects. Safety is crucial — schools must have comfortable shelters where not only can children wait out an alarm but also

continue their learning if needed. Schools should be free of dark corners to prevent bullying. Accessibility must become the new standard, considering how many people are injured or disabled during the war. Schools should be integral parts of the community — they will be the first to be rebuilt. In de-occupied towns and villages, there is a need for infrastructure that supports quality life, which schools can provide, becoming community hubs. A diverse school environment is also essential — time spent outside the classroom is just as important as the time spent learning. Schools are about socialization, setting personal and social boundaries, maturing, and understanding the world around us. Through these approaches, we transform the outdated, ineffective spaces into new, functional ones, fixing the major flaws of the past," explained Victoria Titova, CEO of Big City Lab [7].

What were the main principles for building new schools? The 12 most important ones, divided into the groups:

Mobility and safety:

- a space where children feel secure.
- a space where everyone is welcome and with something to everyone
- spaces are designed for both learning and free time, offering a variety of activities for all students.

Communication:

- School as Part of the Community - schools remain open to the community for learning, recreation, and events.
- The Hall as the Heart of the School Community - the hall becomes a shared space for meetings, group work, and events.
- Corridors — More Than Just Transit - corridors become active areas for work, relaxation, and socializing.
- Reflection of Local Identity - space that reflects the community's character.

Learning:

- Materials that Create a Sense of Home - space designed to feel comforting and familiar.
- Classrooms that Challenge Hierarchy- classrooms encourage open discussion and individual expression.
- Building Relationships Through Visual Contact - design promotes visual connections, creating a sense of community.
- The School Building as a Teacher - the school environment encourages exploration and development [5].

These principles reimagine the school as a multifunctional, and healing space- a cornerstone for rebuilding communities in post-war context.

Conclusion: the study has shown an importance of architecture as a tool for creating comfortable and appropriate condition for learning, regardless of external factors. It is also important to take social aspects into account and consider them when designing space for students.

REFERENCES

1. 12 принципів трансформації українських шкіл. (n. d.) URL: https://bcl.com.ua/projects/12-principiv-transformaciyi-ukrayinskih-shkil-5.
2. Сучасний дизайн, укриття та все необхідне для навчання й розвитку: за якими принципами трансформуватимуть школи. (n. d.) URL: https://cases.media/en/news/suchasnii-dizain-ukrittya-ta-vse-neobkhidne-dlya-navchannya-i-rozvitku-za-yakimi-principami-transformuvatimut-shkoli?srsltid=AfmBOorDcYNBEBFC_cAxcV6h2YN3VP_fvO92YTf61vcOrOuvC4c8Nvsa.
3. Vilna School. (n. d.) URL: https://archello.com/it/project/vilna-school.
4. Destructivism: How does War Affect Architecture?. (n. d.) URL: https://www.arch2o.com/destructivism-how-does-war-affect-architecture/.
5. Education under attack. (n. d.) URL: https://www.unicef.org/education-under-attack.
6. Команда трансформації шкіл презентувала принципи відбудови типових навчальних закладів. (n. d.) URL: https://remariupol.com/news/komanda-transformatsiyi-shkil-prezentuvala-pryntsypy-vidbudovy-typovykh-navchalnykh-zakladiv.
7. The story of post-war school building. (n. d.) URL: https://www.education-uk.org/documents/minofed/pamphlet-33.html.

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CALCULATION OF CIRCULAR PLATES STIFFNESS UNDER VARIOUS TRANSVERSE LOADS AND BOUNDARY CONDITIONS

The analysis of the stress-strain state of plates of arbitrary constant thickness shows that the classical Kirchhoff-Love plate theory underestimates the actual values of the stress-strain state components obtained based on the exact solution of the three-dimensional elasticity theory problem [1, 2]. At the same time, determining the stress-strain state of plates using classical theory can be refined for more accurate results by introducing certain correlation coefficients based on the results, which will be sufficient for engineering calculations [1].

This paper presents calculations of the stiffness of circular plates with simply supported and clamped edges under the action of uniformly distributed loads applied over a circular area, a disk, and an annulus. Some of the results from previous works about deflections, such as deflections over the entire plate area under loading on the circular boundary, displacements of the unloaded region under loading on the disk for simply supported plates, and deflection values for a concentrated force applied at the center, were used [3, 4]. Here, the deflection functions are obtained for the loaded area on the disk and for the entire plate under annular loading.

The objective was to obtain numerical results for stiffness calculations under different types of loading and to conduct an analysis.

Some analytical results obtained are presented below.

Simply supported edge conditions of a plate under uniform load intensity $q_0 = const$, distributed over an annular region with radiuses r_1, r_2 $(0 < r_1 < r_2 < a)$, are

described by the deflection function $w(r)$ for $r \le r_1$ which follows:

$$w(r) = \frac{q_0}{4D}\left(\left(\ln\frac{r_2}{a}\left(\frac{r_2^4}{4} + \frac{r_2^2 r^2}{2}\right) - \left(\frac{r_2^4}{16} + \left(e_1 - e_2\frac{r^2}{a^2}\right)\frac{r_2^2}{2}\left(\frac{r_2^2}{2} - a^2\right) + \frac{r_2^2 r^2}{4}\right)\right) - \right.$$

$$\left. - \left(\ln\frac{r_1}{a}\left(\frac{r_1^4}{4} + \frac{r_1^2 r^2}{2}\right) - \left(\frac{r_1^4}{16} + \left(e_1 - e_2\frac{r^2}{a^2}\right)\frac{r_1^2}{2}\left(\frac{r_1^2}{2} - a^2\right) + \frac{r_1^2 r^2}{4}\right)\right)\right),$$

Where:

$$e_1 = \frac{3+\nu}{2(1+\nu)};\ e_2 = \frac{1-\nu}{2(1+\nu)}$$

The maximum deflection occurs at r = 0:

$$\max / w(r) / = w(r=0) = \frac{q_0}{4D}\left(\left(\frac{r_2^4}{4}\ln\frac{r_2}{a} - \left(\frac{r_2^4}{16} + e_1\frac{r_2^2}{2}\left(\frac{r_2^2}{2} - a^2\right)\right)\right) - \right.$$

$$\left. - \left(\frac{r_1^4}{4}\ln\frac{r_1}{a} - \left(\frac{r_1^4}{16} + e_1\frac{r_1^2}{2}\left(\frac{r_1^2}{2} - a^2\right)\right)\right)\right).$$

Stiffness calculations were conducted for simply supported and clamped plates under various transverse loads and different geometric parameters. The resultant load was taken to be the same in all cases. A quantitative and qualitative analysis of the obtained results was performed. In all cases, the maximum deflection (at the center) increased as the load approached the center and reached its highest value when a concentrated force was applied at the center.

REFERENCES

1. Зеленський, А. Г. (2022). Монографія**.** Варіант математичної теорії трансверсально-ізотропних пластин довільної товщини. Дніпро: ПДАБА.

2. Немиш, Ю. Н., Хома, И. Ю. (1993). Напряженно-деформированное состояние нетонких оболочек и пластин. *Обобщенная теория (Обзор). Прикл. механика*. Т. 29, 11. 3–32.

3. Слободянюк, С. О., Зеленський, А. Г. (2022). *Методичні вказівки до виконання розрахунково-проектувальної роботи "Розрахунок круглих пластин на згин" з курсу "Основи теорії пружності і пластичності" для студентів ступеня бакалавра спеціальності 192 "Будівництво та цивільна інженерія" освітньої програми "Промислове і цивільне будівництво" денної форми навчання*. Дніпро: ДВНЗ ПДАБА.

4. Timoshenko, S., & Woinowsky-Krieger, S. (1959). *Theory of plates and shells* (2nd ed.). McGraw-Hill.

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MODERN APPROACHES TO DESIGNING CHILDREN'S CAMPS

Introduction. In today's world, children's camps play a key role in children's development, providing opportunities for socialization, learning and relaxation. However, many of them need updating and adaptation to modern requirements. The new generation of children grows up in a different moral and social environment, which must be taken into account when designing modern children's camps. Modern children's camps should meet new demands, such as the use of digital technologies, environmental friendliness, safety and accessibility for every child. It's important to create a space where children can combine leisure, learning and development, considering new technologies and the surrounding environment.

Research Aim. This paper aims to propose modern approaches to the design of children's camps.

Research Findings. An analysis of current trends in designing children's camps has revealed modern approaches that should be considered during their development.

One of the modern approaches to designing children's camps is the diversity of opportunities. Children's camps should be organized as multifunctional institutions offering a wide range of activities. Combining different functions in a camp helps children find interests that match their preferences. Leisure, physical activities, learning, wellness programs, and various clubs (artistic, automotive, environmental, sports, technological, etc.) contribute to children's comprehensive development.

Another modern approach is the creation of a barrier-free environment. Modern children's camps must be accessible to all children, including those with limited

mobility. Creating an accessible architectural environment ensures equal access to all camp facilities and promotes socialization among children with diverse needs.

An important modern approach focuses on environmental friendliness. Considering environmental aspects in camp design is essential for fostering children's responsible attitude toward nature. Using eco-friendly building materials, implementing energy-efficient technologies (like solar panels), and developing environmental programs not only preserve nature but also cultivate children's love for the environment.

An additional modern approach is designing camps for year-round operation. Designing children's camps for year-round use is crucial for economic efficiency. Operating camps throughout the year supports various seasonal activities, ensuring continuous development opportunities for children.

Finally, another important approach is promoting social interaction. It's essential to ensure camp accessibility for every child, regardless of their social status or health condition. Inclusivity and providing conditions for children with specific needs to rest and develop within a group enhance their social adaptation and improve communication skills. Socializing at camps offers children an opportunity to explore new relationships within a safe space, all while engaging and learning from a new set of folks [1].

These approaches have been implemented in the project *«Viladoms Children's Summer Camp»*, located in Barcelona and designed by the Office of Architecture in Barcelona (OAB) in 2015. The project focuses on multi-functionality, providing flexible spaces for learning and different activities where children can socially interact with each other. It uses an energy-saving system, reflecting an ecological approach. Additionally, the project includes a barrier-free environment that ensures equal access to all functional areas. The camp was designed for year-round use, welcoming schoolchildren during summer holidays as well as families throughout the year [2].

Figure 1. Viladoms Children's Summer Camp, Barcelona.

Conclusion. Modern design of children's camps focuses on creating environments that support comprehensive child development, aligning with safety, comfort and environmental sustainability standards. Considering factors like diverse opportunities, barrier-free access, environmental friendliness, year-round functionality and social interaction during the design process fosters a nurturing environment for children's growth and learning. Such camps harmoniously integrate contemporary technologies, ecological approaches and a focus on each child's needs, which is vital for their full development and enjoyment.

REFERENCES

1. Benefits of Summer Camp. iD Tech Camps. (n.d.) URL: https://www.idtech.com/blog/benefits-of-summer-camp-infographic (accessed 28.04.2025).

2. Viladoms Children's Summer Camps. Archello. (n.d.) URL: https://archello.com/fr/project/viladoms-childrens-summer-camps (accessed 28.04.2025).

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LIGHTING OPTIMIZATION OF PUBLIC BUILDINGS

Modern public buildings are not only infrastructure facilities, but also spaces that provide comfort, safety and energy efficiency for a large number of people. The lighting system is one of key factors which affect the functionality and perception of such facilities. Inadequate or outdated lighting can lead to reduced productivity, fatigue, poor health, and increased energy costs.

With the growing focus on sustainability, energy efficiency and ergonomics, there is an urgent need to rethink approaches to lighting in public buildings. However, in the Ukrainian context, there is a lack of innovative solutions, such as automated lighting control systems, the use of LED light sources, and insufficient attention to natural light. As a result, there is a practical and research problem to find the optimal approaches to the design and modernization of public building lighting systems that could meet modern requirements for safety, aesthetics, energy efficiency and comfort.

Problem statement. The study deals with the assessment and development of optimal approaches to the design and modernization of office lighting systems that would meet modern requirements for safety, aesthetics, energy efficiency and comfort. The analysis of the existing lighting system of the building was carried out and modernization options were proposed based on lighting software modeling.

Purpose of the study. The purpose of this study is to analyze the efficiency of lighting in the office environment and implement optimization solutions aimed at reducing energy consumption and creating more comfortable conditions for employees. Main objectives:

1. Conduct a technical inspection of the lighting system and measure the illumination with a luxometer;

2. Calculate the need for luminous flux in accordance with the standards for office premises;

3. Select the types and power of LED lamps for the new lighting system.

4. Determine the number of luminaires to ensure the required level of illumination using the automated DIALuxEvoPro system.

5. Perform an economic feasibility study of the proposed lighting replacement options.

Research results. The object of the study has 18 automated workplaces. The lighting system consists of 20 Brille 24W/864 E27 CW G95 (PL-SP) 220V LED lamps located at a height of 2.8 m. An inspection of the lighting system revealed the problem of spot lighting with lamps above individual workplaces, which further reduces the illumination of the room.

To measure the illuminance of the zones of the room, we used:

1. Testo440 - a luxmeter with a remote probe for measuring the illuminance of all types of lamps, a professional multifunctional device with factory calibration;

2. FLUSMT-912 - a portable luxmeter for measuring illuminance in domestic and industrial facilities with an extended range of up to 200000 lux;

3. XiaomiRedmiNote 8 Pro smartphone with the Lux app calibrated with Testo440.

The existing lighting system in the office building does not provide sufficient illumination for the workstations. The measurements showed that the average illuminance of the automated workstations was only 241 lux, which is well below the standard of 500 lux. The building's north- and south-facing stained-glass windows do not provide sufficient natural light, directing light mainly onto vertical non-working surfaces.

Using DIALuxEvoPro software and BIM modelling, two retrofit options were proposed and analyzed:

1. 3F FilippiS.p.A. - L 650 42W/840 DALI EP VSS 596x596 with a luminous flux of approx: 4958 lm with excellent colour rendering (Ra>90), but higher energy consumption (2,376 kWh/year);

2. Philips LL512X LED50S/840 WB, 29 W with a luminous flux of 4994 lm with good colour rendering (Ra>80) and significantly lower energy consumption (1,436 kWh/year).

The economic analysis showed that option 2 (Philips) is the most feasible solution, with a payback period of 7 years and 3 months, while option 1 exceeds 15 years. The study demonstrates that modern lighting solutions can meet regulatory requirements while optimizing energy efficiency, and that smartphone sensors, when properly calibrated, can provide sufficient accuracy for preliminary lighting assessments.

Conclusions.

1. Optimization of the lighting system through the introduction of light-emitting diode (LED) light sources can reduce energy consumption in office premises by 30-60% without losing the illumination level. The most appropriate option is to use Philips LL512X LED50S/840 WB luminaires, which will significantly reduce energy consumption and ensure compliance with regulatory requirements.

2. The use of automated lighting control systems (motion sensors, daylight sensors, timers) helps adapt the lighting environment to the real needs of users, which further reduces energy consumption by up to 20%. To assess the comfort of lighting, smartphone sensors provide sufficient accuracy with wide availability, but a prerequisite is their periodic calibration with professional measuring instruments.

3. Rational zoning of the light space, taking into account the functional purpose of individual areas of the office, provides higher visual comfort, which has a positive effect on labour productivity and reduces staff fatigue.

4. Integration of natural light into design solutions not only reduces the load on artificial lighting during the day, but also improves the psychological well-being of employees. Large glazing areas do not always provide advantages in terms of lighting,

as natural light irradiates vertical non-working surfaces more. Computerized lighting modelling is recommended to quickly test hypotheses and select the best lighting solutions. The higher colour rendering quality of artificial light sources requires much more energy than more energy-efficient lighting, which has lower but sufficient colour rendering to meet the standards for office space.

5. An integrated approach to lighting retrofitting, taking into account lighting standards (e.g. DSTU EN 12464-1:2014), ergonomic requirements and energy efficiency, is a prerequisite for creating a sustainable and productive office environment.

The results of research aimed at determining and improving the level of employee comfort can be used in the future as an example for implementation at such facilities.

REFERENCES

1. DBN V.2.5-28:2018. Pryrodne I shtuchne osvitlennia. Ministry of the Region of Ukraine, 2018 (in Ukrainian)

2. DSTU EN 12464-1 2016 (EN 12464-1). Svitlo ta osvitlennia. Osvitlennia robochykh mists. Chastyna 1. Vnutrishni robochi mistsia. State Enterprise "UkrNDNC", 2018 (in Ukrainian)

3. DSTU 8546:2015, Svitylnyky zi svitlodiodnymy dzherelamy svitla. Zahalni tekhnichni umovy. State Enterprise "UkrNDNC" 2017. (in Ukrainian)

4. Gutierrez-Martinez, J.-M., Castillo-Martinez, A., al. "Smartphones as a Light Measurement Tool: Case of Study". MDPI, 14 June 2017. https://doi.org/10.3390/app7060616. Accessed: 7 November 2023.

5. Spieringhs, R. "The Unified Glare Rating (UGR)" Light & Lighting Blog, March 27, 2023. https://rikspieringhs.nl/UnifiedGlareRating.html. Accessed 7 November 2023

6. Xicato Inc. "Understanding Color Fidelity" XICATO, 2017. https://www.xicato.com/wp-content/themes/xicato/documentuploads/WP %20Understanding%20Fidelity%20print.pdf Accessed: 7 November 2023.

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STRUCTURAL HEALTH MONITORING OF FOUNDATIONS UNDER DYNAMIC LOADING

In modern urban environments, building foundations are increasingly exposed to sustained low-amplitude dynamic loads generated by light rail systems, road traffic, and other anthropogenic sources. While such vibrations are generally perceived as non-critical, growing evidence suggests they may contribute to gradual degradation of foundation systems, including microcracking, settlement, and long-term stiffness reduction – especially when left unmonitored in dense city settings.

Structural Health Monitoring (SHM) offers a promising approach for the early detection of such changes, particularly through vibration-based techniques. These methods assess variations in global dynamic properties – such as natural frequencies, damping ratios, and mode shapes – to infer potential damage or stiffness loss in the structure or its foundation [1]. The previous review highlights that these techniques are increasingly supported by modern signal processing tools, including wavelet transforms and modal assurance criteria, enhancing sensitivity to subtle damage indicators [1].

Moreover, advances in machine learning (ML) and deep learning (DL) have significantly extended the capabilities of SHM systems. Convolutional neural networks and autoencoders are now being used to extract features from raw vibration data, reducing the reliance on handcrafted inputs and enabling real-time pattern recognition [1]. These approaches have proven to be particularly effective in lab-scale applications and are now under consideration to be used in civil infrastructure contexts.

Concrete examples demonstrate how SHM is being applied in various structural settings. For instance, Saidin et al. [2] provide a comparative review of SHM applications in bridges, highlighting how accelerometers and strain-based sensors are integrated into monitoring systems for long-span structures. Another study by Zhou et al. [3] explores the use of low-cost, distributed wireless sensors to monitor damage progression in concrete piles subjected to dynamic loading, suggesting that such systems can be deployed even in cost-sensitive settings.

Wang et al. [4] illustrate how vibration monitoring techniques in pile-supported foundations can be used to assess cumulative damage effects in concrete-filled steel tubes, combining field data with numerical simulations. These examples underscore the growing diversity of SHM applications and point toward the potential of scalable, real-world implementations across foundation types.

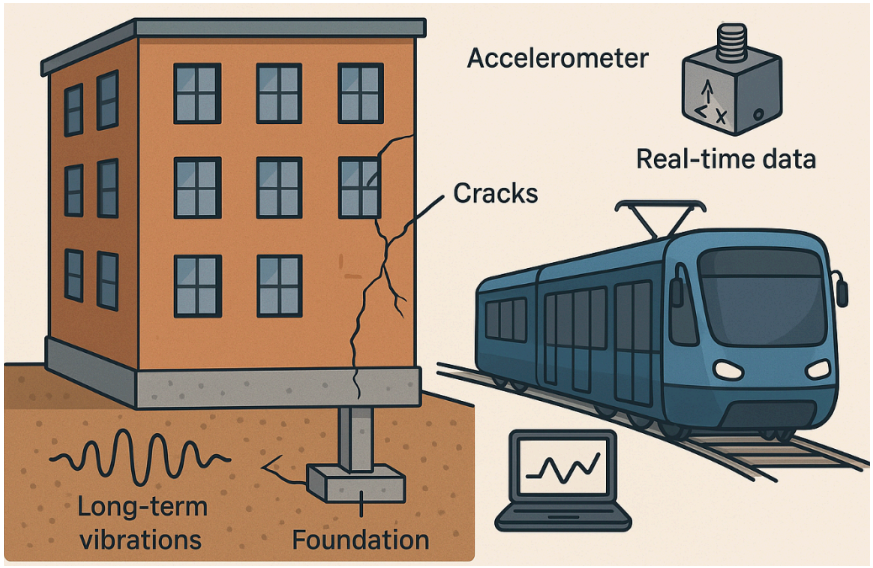

Figure 1 Monitored foundation. Early detection enables maintenace

As an example and a direction for future investigation, Figure 1 demonstrates a conceptual scenario in which a building foundation adjacent to a tram line is monitored for vibration-induced degradation. The study will compare the long-term response of an unmonitored structure with that of a counterpart equipped with cost-effective SHM sensors, aiming to demonstrate the potential for early detection and preventive maintenance through real-time monitoring.

Nevertheless, key challenges persist: the inverse problem of damage localization remains ill-posed and sensitive to noise, SHM systems often face deployment constraints in dense urban environments, and many ML approaches require large training datasets that are not always available. Addressing these limitations is critical for enabling practical, field-ready SHM strategies capable of supporting the resilience of urban infrastructure under dynamic loading.

This abstract outlines the current state of knowledge and aims to contextualize the role of SHM in foundation monitoring as a research direction, emphasizing the need for continued interdisciplinary development that bridges geotechnical, structural, and data-driven methods.

The review concludes by identifying key gaps in current research and proposing a forward-looking approach that emphasizes low-cost, scalable SHM solutions. These solutions could empower building owners, engineers, and city planners to detect and respond to foundation issues early, before they evolve into structural risks. This work sets the stage for future research focused on bridging theoretical understanding with practical, field-ready monitoring strategies for enhancing the resilience of urban infrastructure under the quiet but persistent influence of everyday vibrations.

REFERENCES

1. Zar, A., Hussain, Z., Akbar, M., et al. (2024). *Towards vibration-based damage detection of civil engineering structures: overview, challenges, and future prospects*. Int J Mech Mater Des. https://doi.org/10.1007/s10999-023-09692-3

2. Saidin, S. S., et al. (2022). *The Application of Vibration-Based Techniques in Bridge SHM*. Int J Concrete Struct Mater 16, 69. https://doi.org/10.1186/s40069-022-00557-1

3. Zhou, Y., et al. (2024). *Performance of wireless sensor network in concrete pile damage detection under dynamic loading*. J Infrastruct Preserv Resil 5, 1. https://doi.org/10.1186/s43251-024-00155-z

4. Wang, X., et al. (2023). *Experimental and numerical investigation of damage accumulation in concrete-filled steel tube piles under repeated axial loading*. J Infrastruct Preserv Resil 4, 81. https://doi.org/10.1186/s43251-023-00081-6

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ARCHITECTURE AND CONSTRUCTION: SUSTAINABLE DEVELOPMENT, INNOVATIVE MATERIALS AND TECHNOLOGIES

In today's world, where scientific and technological progress is advancing rapidly, the construction industry is not standing still. It is evolving, improving, and becoming increasingly high-tech. At the heart of this transformation are sustainability, environmental friendliness, and efficiency. These principles apply both to the building materials and the technologies used in construction.

In my opinion, one of the most important aspects of modern construction is ecological sustainability. Human health and care for the environment directly depend on the materials used to build our homes. Moreover, modern materials should not only be safe but also contribute to the rapid construction of buildings (a factor especially relevant given the ever-growing demand for housing and infrastructure).

Among the environmentally friendly materials that deserve attention, I would like to highlight bamboo, a lightweight, strong, and fast-growing resource. It matures in just three years, unlike northern wood species, which require decades. Although bamboo is not commonly used for residential buildings in our country, it is widely applied in the design of gazebos, furniture, and decorative elements. Another example is clay, which has been used since the Neolithic era. Combined with straw, it forms adobe, a material with excellent thermal insulation properties. We should also not forget stone (such as limestone, granite, and sandstone), which still remain indispensable in foundations and facades due to their strength and durability.

Alongside new materials, construction technologies are also advancing rapidly. These innovations not only increase building efficiency but also make it possible to implement complex projects in short timeframes and under various conditions.

One of the most groundbreaking innovations is 3D printing, a technology for creating three-dimensional objects from building mixtures. It significantly reduces material consumption, minimizes waste, and enables construction in hard-to-reach areas. Another promising solution is modular construction. Prefabricated blocks are transported to the site and quickly assembled into a complete structure. These buildings are easy to modify, reconstruct, or expand, which is especially important for modern urban environments.

While new technologies and materials truly make life easier, we must not forget the value of tradition. It is on the foundation of traditional practices that new approaches often arise. The combination of time-tested methods with modern innovations allows construction to be not only efficient but also harmonious, sustainable, and future-oriented.

Thus, the development of architecture and construction is based on a balance between the new and the traditional. And it is precisely in this combination that the key lies to creating a comfortable, safe, and environmentally friendly environment for future generations**.**

REFERENCES

1. 10 несподіваних будівельних технологій, які можуть змінити світ. (n.d.). https://iino.knuba.edu.ua/bloh/298-10-nespodivanykh-budivelnykh-tekhnolohii-iaki-mozhut-zminyty-svit

2. Будівельні матеріали нового покоління. (n.d.). https://mizol.ua/ua/stroitelynye-materialy-novogo-pokoleniya?srsltid=AfmBOoq3Mxk_7y3njV6y5fi1W7K22Rr6DH6bebwBC0pAfK19cQLV7hid

3. Інновації у будівельній індустрії: ТОП сучасних впроваджень у будівництві. (n.d.). https://magdek.com.ua/ua/top-15-innovacii-v-stroitelnoi-industrii-chto-seichas-trendovo?srsltid=AfmBOoqphtDfp9ptRcG63vQ5PljkUO4Z0b6vRxRNVF6-z-DEh_Xk3EFd

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WAYS TO REDUCE CONSUMPTION OF NON-RENEWABLE ENERGY TYPES IN MICROCLIMATE SYSTEMS OF BUILDING PREMISES

The main condition for the operation of any technology at present is the reduction of consumption of non-renewable energy in the systems for providing the microclimate of the premises of buildings.

Improving indoor comfort is one of the areas of further development of life support systems in the premises of buildings.

The current energy crisis dictates a new technological policy, which is based on the principle of energy conservation, strict control of its consumption. Analysis of energy consumption for providing the microclimate in the premises of buildings over the p/ast decade has shown that it has grown significantly. At the same time, it should be expected that the trend of its growth will be maintained with the expected economic growth. Currently, energy obtained from non-renewable energy sources (coal, oil, gas) is used to operate microclimate systems.

Reduction of energy consumption in building indoor microclimate systems can be achieved: by means of highly efficient thermal protection of the outer shell of buildings; by means of using renewable energy sources (sun, wind, biomass, heat of soil and water bodies, etc.); by means of creating highly efficient technology for providing indoor microclimate in buildings.

Experience in creating highly efficient outer shells of buildings in world practice is very large.

Providing microclimate based on renewable energy sources is the most environmentally friendly and is a modern highly efficient technology for providing microclimate.

One of the promising areas of development of modern energy is the use of

renewable energy sources for heat and cold supply of building indoor microclimate systems based on heat-using units of combined heat and cold production - absorption heat converters (AHC). These thermal transformers are a thermodynamic system in which heat is transformed using combined direct and reverse cycles. APTs are highly efficient, environmentally friendly, quiet in operation, easy to maintain, have a long service life, and are fully automated.

Based on these thermal transformers, a technology has been proposed and a basic diagram of its operation has been developed for year-round provision of microclimate parameters in building premises with the integrated use of solar, wind and biomass energy, as well as soil and water energy. Due to the instability of the parameters of this energy, accumulation is provided. In case of a shortage of renewable energy, a backup energy source is provided.

Analysis of the heat and air balance of the premises showed that a reduction in energy consumption by microclimate systems should be achieved by:

- optimizing air exchange and reducing the amount of supply air to the required minimum;
- zoning of premises by the area of the working or serviced zone;
- using purification and recirculation of internal air;
- using natural air movement stimulators;
- monitoring the state of the internal atmosphere and managing its parameters.

In order to solve the problem of reducing energy costs, it is proposed to provide a microclimate in the premises by two simultaneously operating systems:

• a system for year-round provision of thermal comfort in the premises due to surface-developed heating (in the transitional and cold periods of the year) and cooling (in the warm period of the year);

• an air conditioning system.

REFERENCES

1. Chesanov, L.G., Petrenko, V.A. (2001). The condition of the microclimate in the premises with different heating technologies. *Construction. Material Science. Engineering*.; Iss. 13.. 22-25.

2. Kraft, H. (1983). Low - temperature heating systems. Transl. from German Bulkin S.H. M.

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SUSTAINABLE DEVELOPMENT AND BIM IN MODERN CONSTRUCTION

Sustainable development in architecture and construction involves the construction of facilities that meet the needs of modern society without compromising the opportunities of future generations. The main goal is to minimize the consumption of energy and natural resources, use environmentally friendly materials, reduce CO_2 emissions and waste, and provide comfortable living and working conditions. Particular attention is paid to the entire life cycle of the building - from design to dismantling. This approach is implemented through the principles of green building, environmental certification (LEED, BREEAM, DGNB), and regenerative design.

Innovative materials play a key role in achieving sustainability. These include self-healing concrete that “heals” microcracks with the help of bacteria or polymers, energy-saving glass with special coatings that regulate heat transfer, and recycled materials that reduce construction waste. Technologies such as aerogels and nanocomposites provide effective thermal insulation with minimal weight and volume.

Digital tools, such as Building Information Modeling (BIM) technology, have become an integral part of sustainable construction. BIM is not just a 3D model, but a comprehensive information system that contains data on all aspects of a building: construction, materials, engineering, energy efficiency, cost (5D), schedule (4D), and even operation (6D). Its use allows you to coordinate the actions of all project participants, minimize errors, optimize resources and costs, and predict energy consumption at the design stage.

Examples of modern implementations of a sustainable approach include CopenHill in Copenhagen, which combines the functions of a waste incinerator, ski slope, and green recreation area. Its modern technologies allow it to provide energy to more than 150,000 households. Another example is One Central Park in Sydney, where vertical gardens with automatic irrigation, a system of heliostat mirrors and the use of renewable energy demonstrate the close integration of ecology, engineering and architecture.

Thus, sustainable development in construction is not just a trend, but a real strategy based on the introduction of the latest technologies, environmental responsibility and an integrated digital approach to creating a comfortable and safe environment.

REFERENCES

1. Architecture 2030. (2024). Achieving Zero. https://architecture2030.org/zero-tool/.
2. Ateliers Jean Nouvel. (n.d.). https://www.jeannouvel.com/en/projects/one-central-park/].
3. Autodesk. (2023). What is BIM? https://www.autodesk.com/solutions/bim.
4. CopenHill Official. (n.d.). https://www.copenhill.dk/.
5. Dezeen. (n.d.). Bosco Verticale by Boeri Studio. https://www.dezeen.com/2014/10/23/bosco-verticale-milan-stefano-boeri/.
6. World Green Building Council. (2020). Bringing Embodied Carbon Upfront. https://www.worldgbc.org/embodied-carbon.

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INTEGRATED USE OF PROJECT EXPERT AND MICROSOFT EXCEL TO ENHANCE THE IMPLEMENTABILITY OF INVESTMENT PROJECTS IN CONSTRUCTION

Growing competition in the construction industry requires improved approaches to managing investment projects. Traditional software tools, such as Microsoft Project, Primavera P6, Open Project, and others, provide basic planning and resource and financial management functions, but have limitations in terms of modern assessment of project implementation and adaptation to changes in external factors. They are based mainly on classical management approaches and do not sufficiently take into account the aspects of resource provision, implementation deadlines and financial sustainability. Project Expert focuses on the financial and economic assessment of projects but does not provide flexibility for modeling alternative management solutions [1-2]. There is a need to implement combined solutions. The integration of Project Expert and Microsoft Excel capabilities allows to create analytical models to assess the implementation, sensitivity, and sustainability of projects, which helps to increase the efficiency of construction project management investment [3]. Let us consider a comparative description of the main approaches, table 1.

Research objective. Development of a comprehensive approach to increasing the implementability of investment projects in construction by combining the analytical capabilities of Project Expert and Microsoft Excel is of great importance. Particular attention is paid to the analysis of resource availability not only in terms of volume, but also in terms of consumption intensity at different stages of the calendar plan implementation.

Table 1

Comparative characteristics of software tools for managing investment projects

Criterion	Microsoft Project / Primavera / Open Project	Project Expert	Project Expert + Microsoft Excel
Schedule Planning	✅	✅	✅
Resource Management	✅	✅	✅
Financial and Economic Assessment	❌	✅	✅
Scenario Modeling	❌	✅	✅
Managerial Implementability	❌	❌	✅
Visualization of Charts / Diagrams	✅	✅	✅
Analytics Flexibility	❌	❌	✅
Adaptability to Environmental Changes	❌	❌	✅
Support for Managerial Decision-Making	❌	❌	✅

Research findings. Project Expert and Microsoft Excel data integration allows for multi-factor analysis of resource utilization, determination of reserve levels, and assessment of project management sustainability. This approach allows for forecasting deviations from the plan, identifying critical phases, and taking timely corrective actions.

Advantages of Integrated Use:

- Increasing the accuracy of feasibility assessment;

- Comprehensive analysis of interdependent factors «time - cost - efficiency – reliability»;

- Flexible resource management;

- Reducing the risks of failure to meet planned indicators;

- Ensuring the adaptability of projects to changes in the external environment.

Conclusion. The integrated use of Project Expert and Microsoft Excel significantly improves the quality of planning and management of investment projects

in construction. This approach allows not only to allocate resources for construction projects, but also to analyze their use in detail at different stages of the project, ensuring more flexible management. The integration of these tools helps to increase the feasibility of projects, their resistance to change and growth the effectiveness of achieving goals.

REFERENCES

1. Cleland, David I., Bopaya, Bidanda. (2019). *The Evolution and Maturity of Project Management*. Project Management Institute. Pennsylvania.
2. Kerzner, H., Ward, J. LeRoy. (n.d.) The future of project management. https://www.iil.com/resources/futureof-project-management-v2.pdf
3. Mlodetskiy, V.R., Tkach, T.V., Sepek, K.A. (2018). Kombinovane vykorystannya prohram Project Exprut, MS Excel dlya vyrishennya zadach po upravlinnyu proektamy. *Stroitel'stvo, materialovedeniye, mashinostroyeniye*, 106. 96-101.

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MATÉRIAUX DE FAÇADE MODERNES POUR HÔTELS: INNOVATIONS VERS L'EFFICACITÉ ÉNERGÉTIQUE ET LE DÉVELOPPEMENT DURABLE

Énoncé du problème. Les complexes hôteliers modernes sont des structures qui doivent répondre non seulement à des exigences esthétiques, mais aussi à des critères d'efficacité énergétique, de fonctionnalité et de développement durable. L'architecture d'un hôtel, en particulier sa façade, constitue un élément clé dans la formation de la

première impression du bâtiment, tout en déterminant son efficacité énergétique, sa durabilité et le confort de l'environnement. Le choix du matériau de façade influence considérablement les coûts d'exploitation, l'empreinte écologique du bâtiment et son intégration dans l'environnement urbain.

Dans le contexte du renforcement des exigences écologiques et de l'augmentation du coût des ressources énergétiques, les façades acquièrent de nouvelles fonctions, notamment en matière d'économie d'énergie et de protection. Cela entraîne un développement rapide de solutions innovantes dans le domaine de la construction de façades, notamment l'émergence de nouveaux matériaux, de technologies de montage et de systèmes intégrés dans le modèle énergétique global du bâtiment. Dans le secteur hôtelier, où la rentabilité économique et la représentativité jouent un rôle majeur, la mise en œuvre de telles solutions est particulièrement pertinente.

Objectif de la recherche. L'objectif est de déterminer les avantages des matériaux de façade modernes utilisés dans la conception des hôtels, en termes d'innovation, d'efficacité énergétique et de conformité aux exigences du développement architectural durable. La méthodologie adoptée repose sur une analyse approfondie des informations relatives aux matériaux de façade modernes, ainsi que sur une approche comparative permettant d'évaluer leurs caractéristiques techniques et opérationnelles. Par ailleurs, une analyse d'objets architecturaux réalisés avec des solutions de façade innovantes a été menée.

Résultats de la recherche. Les principales exigences pour les façades modernes des hôtels sont: efficacité énergétique, durabilité, sécurité, esthétique et respect de l'environnement. L'étude a révélé que les matériaux les plus couramment utilisés sont:

- Panneaux composites en aluminium — légers, résistants à la corrosion, adaptés aux formes complexes;
- Plaques de fibrociment — résistantes au feu, perméables à la vapeur, avec une longue durée de vie;

- Verre à revêtements sélectifs — permettant une lumière naturelle tout en conservant la chaleur;
- Façades photocatalytiques — capables de s'auto-nettoyer et de réduire la pollution de l'air;
- Isolation thermique innovante (aérogels, panneaux PIR) — permettant de réduire l'épaisseur des structures d'enveloppe.

Une attention particulière est portée aux systèmes de façade ventilée, qui assurent une ventilation naturelle et réduisent la charge sur les systèmes de chauffage et de refroidissement.

À titre d'exemples, deux objets hôteliers ont été analysés:

Hotel Hotel (Australie) — La façade est réalisée en bois recyclé, ce qui souligne non seulement l'esthétique naturelle du bâtiment, mais contribue également à réduire son empreinte carbone. L'utilisation d'un système de ventilation naturelle et d'un toit vert permet de diminuer considérablement la consommation d'énergie. Des matériaux locaux ont été employés dans l'aménagement, renforçant ainsi l'intégration du bâtiment dans son environnement.

Treehotel (Suède) — Une série de chambres d'hôtel situées dans les arbres, où chaque construction possède une façade unique. La chambre la plus célèbre, le «Mirrorcube», est entièrement recouverte de verre miroir, reflétant la forêt et rendant la structure presque invisible. Cette solution assure une harmonie avec la nature, minimise l'impact visuel sur l'environnement et maximise l'ensoleillement naturel à l'intérieur.

Conclusion. Les matériaux de façade modernes pour les hôtels ont une fonction multifonctionnelle: ils façonnent non seulement l'image architecturale, mais influencent également de manière significative l'efficacité énergétique du bâtiment, sa durabilité et le confort d'utilisation. L'intégration de solutions innovantes dans les systèmes de façade permet de réduire l'impact environnemental négatif et s'inscrit dans les tendances de la construction durable. Le développement constant des technologies

dans ce domaine constitue la clé d'une transformation qualitative de l'architecture hôtelière.

RÉFÉRENCES

1. Maslennikova, V. V. (2024). Matériaux et structures de construction modernes: guide méthodologique.
2. Burry, M. (2011). Scripting Cultures: Architectural Design and Programming.
3. Chudley, R., Greeno, R.(2016). Building Construction Handbook. Routledge.
4. Systèmes de façade contemporains pour la construction à haute efficacité énergétique – https://budport.com.ua.
5. Revue des matériaux de façade: avantages et inconvénients. (2023). Portail de l'architecture d'Ukraine.

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OPTIMIZATION OF PLASMA COATING DEPOSITION PARAMETERS

Abstract This thesis explores the development of optimal technological parameters for ion-plasma spraying of mold surfaces, with a focus on replacing scarce and expensive tungsten-containing steels. The study evaluates coatings of titanium nitride applied to 4X5MFS and 5XNM steel grades under varying nitrogen pressures. Experimental findings demonstrate that coatings obtained at a nitrogen pressure of 1 Pa offer superior protective characteristics, including increased corrosion and scale resistance.

Introduction The durability and efficiency of die-casting molds are significantly influenced by the wear resistance and thermal stability of their working surfaces [5].

Traditional tungsten-containing steels, such as 3X2V8F, are becoming increasingly scarce, necessitating the search for alternative materials and protective coatings. Plasma coating technologies offer a viable solution, enhancing mold longevity and reducing maintenance costs. This study investigates the application of titanium nitride coatings on alternative steel grades using ion-plasma deposition, identifying optimal process parameters to maximize performance.

Methodology The research focuses on the application of titanium nitride coatings to 4X5MFS and 5XNM steel grades, selected for their mechanical properties and absence of tungsten [1]. The coatings were deposited using the condensation with ion bombardment (CIB) method, utilizing a “Bulat-3T” unit. Experimental variables included nitrogen pressure (ranging from 3×10^-3 to 1 Pa) and substrate temperature. Coating thicknesses between 2 to 5 μm were tested to determine adhesion strength, thermal endurance, and resistance to corrosion and oxidation [2].

Results and Discussion The study reveals that nitrogen pressure significantly impacts coating performance. Coatings applied at lower pressures (3×10^-3 to 3×10^-2 Pa) exhibited high microhardness but increased brittleness due to lattice distortions. Conversely, coatings applied at 1 Pa displayed improved plasticity and reduced brittleness while maintaining adequate hardness, leading to superior wear resistance [3]. Laboratory tests indicate that titanium nitride coatings applied at optimal parameters increase mold corrosion resistance threefold and scale resistance by a factor of 2-4.

Thermal endurance tests demonstrated that molds coated at 1 Pa withstood up to 12,000 heating-cooling cycles, compared to 2,000 cycles for uncoated molds[4]. Additionally, adhesion evaluations showed that coatings of 2-5 μm thickness adhered best to the substrate, with thicker coatings (above 5 μm) prone to peeling.

A key factor affecting coating performance is the nitrogen pressure during deposition. Table 1 presents the effect of nitrogen pressure on coating characteristics, showing variations in microhardness and color.

Table 1: Influence of Nitrogen Partial Pressure on Coating Characteristics

Nitrogen Pressure (Pa)	Microhardness (GPa)	Coating Color
3×10^-3	22.0	Gray
3×10^-2	26.0	Yellowish-gray
4×10^-1	23.0	Yellow
1	18.0	Brownish-golden

The influence of nitrogen pressure on the thermal endurance of the coatings is presented in Table 2, demonstrating the improvement in durability of coated mold parts compared to uncoated ones.

Table 2: Influence of Nitrogen Partial Pressure on Thermal Endurance

Steel grade	Pressure				
	uncoated	3·10 -3	3·10 -2	4·10 -1	1
	Thermal endurance				
4Х5МФС	2,000	3,000	5,000	9,500	12,000
5ХНМ	2,000	3,500	5,000	9,000	11,500

Conclusion The findings underscore the effectiveness of ion-plasma titanium nitride coatings in enhancing the performance of die-casting molds. By optimizing nitrogen pressure at 1 Pa and maintaining a substrate temperature of 500°C, it is possible to achieve coatings with superior adhesion, reduced brittleness, and enhanced durability. The implementation of these optimized parameters can significantly improve mold longevity, reduce operational costs, and minimize reliance on scarce tungsten-based materials.

Future Work Further studies should explore the application of alternative coating compositions and deposition techniques to refine the mechanical properties of mold coatings. Additionally, industrial-scale testing will be necessary to validate laboratory findings and ensure practical viability in manufacturing environments.

REFERENCES

1. Hoffman, M. (2005). What you should know o mold steels. *Plast. Technol*, N 28(4), 28-30.

2. Kalinina, N.E., Glushkova, D.B., Voronkov, A.I., Kalinin, V.T. (2019). Influence of nanomodification on structure formation of multicomponent nickel alloys. *Functional Materials*. 3(26).

3. Kostin, V.A., Grigorenko, H.M., Zhukiv, V.V.(2016). Modification of the structure of welds of high-strength, low-alloy steels with nanoparticles of refractory metals. *Collection of scientific works "Construction, materials science, mechanical engineering"*. 89, 93-98.

4. Petrychenko, A.M., Novyk, O.O., Krylov, V.I., et al. (1990). Selection of steel for forms of LPD of aluminum alloys. *Foundry production*. 3, 8-9.

5. Vahrusheva, V.S., Hlushkova, D.B.,Volchuk, V.M., Nosova, T.V., Mamhur, S.I., Tsokur, N.I., Bagrov, V.A., Demchenko, S.V., Ryzhkov, Yu.V., Scrypnikov, V.O. (2022). Increasing the corrosion resistance of heat-resistant alloys for parts of power equipment. *Problems of Atomic Science and Technology*. 4(140), 137-140; https://doi.org/10.46813/2022-140-137

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PROBLEMS OF OPERATION AND RECONSTRUCTION OF SMALL HYDRAULIC STRUCTURES IN UKRAINE

Small hydraulic structures in Ukraine are elements of engineering infrastructure that play a key role in runoff regulation, water supply, irrigation, fish farming, and flood protection. However, a significant number of these structures were built in the second half of the 20th century and are now in unsatisfactory technical condition.

According to the State Agency of Water Resources, there are over 50,000 small hydraulic structures in Ukraine, including reservoirs, ponds, sluice gates, dams, and water outlets [1]. Most of them were constructed during the 1950s–1980s and are currently operated beyond their normative service life. Due to limited funding and inadequate legal regulation, technical inspections are not conducted properly, and certification is only partially performed.

The main technical issue is the wear and degradation of structural components such as waterproofing materials, gate mechanisms, and concrete or earth-fill dams. Frequent breaches in dam tightness and filtration stability often result in breakages and flooding. Particularly dangerous are emergency situations caused by violation of operational rules and insufficient personnel qualifications [2].

Improper operation contributes to waterlogging, soil salinization, reservoir siltation, and loss of biodiversity. Disturbances in the hydrological regime create conditions for algal blooms and accumulation of toxic substances in bottom sediments. The absence of fish ladders in most structures creates barriers to the migration of aquatic biological resources [3].

Reconstruction of small hydraulic structures should take environmental requirements into account. However, in practice, priority is often given to economic functions such as irrigation, which can result in violations of environmental protection regimes. It is necessary to introduce mandatory state monitoring of the technical condition of small hydraulic structures with centralized data collection. This will require funding and the creation of an electronic registry of all existing structures.

The modernization of small hydraulic structures should include the installation of fish ladders, creation of buffer zones for pollution protection, and flow regulation considering ecosystem needs. The implementation of nature-based solutions (green infrastructure) is a promising direction [4,5].

Conclusions. Small hydraulic structures in Ukraine require a systematic approach to their operation and modernization. Issues of deterioration, legal ambiguity, and ecological threats emphasize the need for governmental regulation and targeted financing. Only through the implementation of a monitoring system, support for reconstruction programs, and ecological reorientation of infrastructure can sustainable water management development be ensured.

REFERENCES

1. State Agency of Water Resources of Ukraine. (n.d.). Information on hydraulic structures. Retrieved from https://www.davr.gov.ua/

2. Kovalenko, O. I., & Chernenko, S. P. (2021). Condition and problems of operation of small hydraulic structures in Ukraine. Visnyk Budivnytstva (Construction Bulletin), (2[58]), 24–29.

3. Stashuk, V. A., & Nosal, I. V. (2019). Ecological safety of small reservoirs and ponds. Kyiv: Osvita Ukrainy Publishing House.

4. Holubiev, Y. M. (2020). Reconstruction and greening of small hydraulic structures: Engineering solutions. Hydrotechnical Construction, (3), 41–48.

5. Xu, K., Milliman, J. D., & Yang, Z. Sediment load response to climate change and *human activities during the past 50 years: An example from the Yellow River basin, China.* Global and Planetary Change, 100*, 238–249. https://doi.org/10.1016/j.gloplacha.2012.11.003*

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ENSURING THE POSSIBILITY OF CONDUCTING UNDERGROUND CONSTRUCTION

Nowadays, the necessity of conducting underground construction is increasing significantly. The basement levels of old buildings were designed with only one purpose: the installation of engineering systems. In addition, old constructions had small loads on the foundations, therefore, they were built at a minor depth. However, modern needs require abandoning the design of such objects. The main reasons that determine the construction of in-depth and underground structures, are the necessity of effectively utilising the building area, as increasing the number of storeys significantly raises loud and, consequently, the foundation depth, and compliance with new design standards (the need to provide built-in parking and shelters for people).

Until recently, the main method of conducting underground construction was the development of an open pit with sloping slopes [3]. It is the easiest and the most economical, but all of these benefits turn out to be at a shallow depth and with deep groundwater [2]. Another method is the installation of a sinking well [1]. The basic idea is to construct a circular fencing structure that gradually sinks as soil is excavated from inside it. This allows to reach the substantial depths, but construction of a sinking well may cause subsidence of already existing buildings [2]. Both of the above

mentioned techniques require a large area of construction site, which is impossible in the context of urban development.

Fencing structures are used for pits on city territory and are installed before the start of soil development and can have a complex shape in plan. These structures can be divided into 5 types.

The first one is the fence made of metal elements with lagging [3]. It is the simplest and the cheapest to install. Its disadvantages include the need for good geological conditions with a low groundwater level, low strength and rigidity, water permeability of the structure, noise and vibration during construction, and a relatively small possible shallow pit depth [2].

An analogue of the previous technique is the sheet pile fence [1]. It is also very simple to install. Such fence is waterproof and less dependent on geological conditions. The disadvantages include the inability to be installed in fragmented and rocky soils, noise and vibration during construction and a minor pit depth [2].

The third and fourth types are the diaphragm wall and the fence made of drilled piles [1]. They can be constructed in any geological conditions, they are waterproof and they allow to create a pit with a relatively large depth. However, construction complexity and high cost are the disadvantages [2].

The last method of fence installation is the «jet-grouting» technology [3]. It has average indicators of the four previous approaches. The disadvantages include the impracticality of use in weak, fragmented or rocky soils, as well as high cost [2].

Additionally, one of the main problems of all fence structures is their rigidity, therefore, swelling pit depth significantly increases the movements of fences. There are 5 possible solutions to this issue.

The first method of resisting deformation is the installation of anchors [3]. It is more convenient for work inside the pit because its entire internal space remains open. This approach is also more practical for pits with a large width or no opposite walls [2].

The second technique involves the installation of a temporary bracing strut system made of metal elements [3]. This approach is more practical for pits with relatively short distance between their opposite walls [2].

An analogue of the previous method is the installation of a bracing strut system in the form of horizontal reinforced concrete trusses. The advantage of such structures is the possibility of their further use as a part of ribbed slabs for underground floors [2].

The fourth way of ensuring rigidity is the construction using the «top-down» technology. The concept of this method is that all vertical structures, such as diaphragm walls and piles, are built first, and then, simultaneously with the excavation of the pit, horizontal structures, which act as bracing struts and underground floor slabs, they are installed [2].

The final way is the construction of T-shaped retaining walls or fences with buttresses. This type of wall is an improved version of diaphragm walls. In practice, the pit is first excavated with fence made of diaphragm walls, using a temporary bracing strut system. After that, foundation slab and buttresses are built and the temporary bracing struts are removed. This technique is practical for large pit areas, where T-shaped retaining walls are installed on one side of a temporary trench, then the entire internal space between main fences is fully excavated [2].

Thus, at present, one of main challenges in construction is how to possibly ensure the realisation of in-depth and underground building projects. All the necessary technical and scientific capabilities already exist, and there are even some ready-made solutions, but the work in this field remains highly relevant.

REFERENCES

1. Зоценко, М. Л., Коваленко, І. В., Яковлєв, А. В., Петраков, О. Є., Швець, В. Б., Школа, О. В., Біда & С. В., Винников, Ю. Л. (2003). *Інженерна геологія. Механіка ґрунтів, основи і фундаменти: Підручник*. ПНТУ.

2. Кріпак, В., Колякова & В., Шпакова, Г. (2024). Забезпечення стійкості глибоких котлованів висотних споруд. *Будівельні конструкції: теорія і практика*, *14*(4), 41–56. doi: 10.32347/2522-4182.14.2024.41-56

3. Шутенко, Л. М., Рудь, О. Г., Кічаєва, О. В., Самородов, О. В., & Гаврилюк, О. В. (2017). *Механіка ґрунтів, основи та фундаменти: Підручник*. ХНУМГ ім. О. М. Бекетова.

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ENGINEERING CLIMATE CONTROL SYSTEMS FOR MAINTAINING MICROCLIMATIC PARAMETERS IN NZEB

Problem Statement. In Europe, buildings are the largest consumers of energy, accounting for up to 40% of total consumption, with approximately 80% of this energy used for heating, cooling, and hot water supply. This high level of energy consumption is particularly evident in residential buildings, schools, nurseries, hospitals, and administrative facilities. European countries aim to become the world's first climate-neutral continent, which necessitates minimising the use of fossil fuels for heating, cooling, and hot water provision in buildings. To achieve this objective, a design standard for the construction of nearly zero-energy buildings – Nearly Zero-Energy Buildings (NZEB) – has been developed [1, 2]. NZEBs are a crucial component in ensuring the energy independence of European nations and achieving global environmental goals, including decarbonisation by 2050. In Ukraine, the regulation "Some Issues Regarding the Implementation of Requirements for Buildings with Nearly Zero Energy Consumption" was adopted [2]. This document sets out the fundamental criteria to be met in the design of new and refurbished buildings. These requirements will play a crucial role in both the reconstruction of destroyed buildings and the design of new structures in Ukraine. A key aspect of these requirements

concerns the design of engineering climate control systems that utilise renewable energy sources. An important task is the development of a methodology for the selection of equipment and the creation of efficient operational schemes aimed at harnessing renewable energy to maintain optimal indoor microclimatic conditions during the heating and cooling of various building types across different regions of Ukraine.

The research aims to develop a methodology to assist in selecting the optimal combination of heating and cooling generation equipment and engineering systems that maintain indoor microclimatic conditions in NZEB buildings.

Main Body. The main parameters of the indoor microclimate that affect human comfort and health include air temperature, surrounding surface temperature, relative humidity, air velocity, the concentration of harmful substances, and the level of illuminance. Although illuminance is not a thermodynamic parameter of the microclimate, it remains a significant factor for comfortable occupancy and has an impact on well-being. The most critical parameter influencing comfort is the indoor temperature. The thermal environment within a room must meet comfort requirements.

The fundamental principles of NZEB design are centred on the following key aspects [1, 2]:

a) the energy efficiency of the building envelope;

b) the use of climate control engineering equipment in conjunction with renewable heat and cooling sources;

c) intelligent control systems for regulating heating and cooling generation and their consumption;

d) minimising the use of carbon-based energy sources;

e) the utilisation of environmentally friendly materials;

f) the adoption of optimal building orientation during the design phase to maximise solar energy use and account for local climatic conditions.

The most comfortable thermal conditions are provided by low-temperature heating systems, which ensure minimal temperature variations within the room and do

not cause negative sensations. Modern low-temperature climate control heating systems are developed following the European standard EN 422-1/2, based on the use of a heat carrier with an inlet temperature of t_{in} = 55°C and an outlet temperature of t_{out} = 45°C [3]. Moreover, renewable heat sources predominantly generate a heat carrier within this temperature range.

For the sustainable provision of heating and cooling to the rooms of NZEB buildings, combined heat generation and distribution systems are widely used. The joint utilisation of multiple heat energy sources with different types of generation and various heat distribution systems is referred to as combined systems. Such combined systems include heating and cooling generation equipment and climate control heat and cooling distribution systems.

Conclusions. The development of a methodology for the substantiated selection of the composition of combined engineering systems that ensure thermal comfort in NZEBs, taking into account the thermal and structural properties of the building envelope and local climatic conditions, will contribute to improving project quality and reducing dependence on fossil fuels.

REFERENCES

1. DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. Available from: URL:https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0844

2. Ministry for Communities and Territories Development of Ukraine. (2025). Some Issues Regarding the Implementation of Requirements for Buildings with Nearly Zero Energy Consumption. Order No. 168 dated 06.02.2025. Kyiv. Available from: URL: https://www.google.com/search?q=https://zakon.rada.gov.ua/laws/show/z0284-25%23Text

3. DSTU EN 442-1:2019 (EN 442-1:2014, IDT) (2019). Radiatory ta konvektory. Chastyna 1. Tekhnichni umovy ta vymohy. DP «UkrNDNTs» K. URL: https://online.budstandart.com/ua/catalog/doc-page?id_doc=87840

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A MULTIFUNCTIONAL CULTURAL CENTER IN DNIPRO CITY

Cultural heritage is a set of objects inherited by humanity from previous generations, the result of spiritual and material activity.

A distinction is made between tangible and intangible cultural heritage.

The material cultural heritage includes:

- monuments of architecture and monumental art and similar archaeological and historical monuments, as well as related natural objects;
- various places of interest;
- manuscripts, books, archival materials, all kinds of objects of artistic, historical or archaeological significance, scientific collections of artistic, historical, ethnographic or scientific significance.

The intangible cultural heritage includes traditions, customs, rituals, holidays (celebrations), songs, traditional crafts, and other forms of preserving and demonstrating experience, skills and knowledge that are important to individual communities and are passed down from generation to generation.

The cultural heritage of the Dnipro region includes: material and intangible cultural attractions.

Material cultural heritage includes:

- Petrykivka Decorative Painting as a Phenomenon of Ukrainian Ornamental Folk Art (2013);
- Tradition of Kosovo painted ceramics” (2019);

To the intangible cultural heritage belone:

- “Cossack songs of Dnipropetrovs'k region” (2016)

Petrykivka decorative painting is a unique folk art of the Dnipro region, which is part of Ukrainian culture and has been passed down from generation to generation.

The origin and name of the mural are related to the village of Petrykivka, located in the Dnipro region. The village was founded by the legendary Zaporizhzhian Sich ataman Petro Kalnyshevskyi as a Cossack winter camp that was part of the Protovchanska Palanka during the years of the New Sich (1734-1775).

The Petrykivka painting includes a variety of flowers, leaves, and berries, which in itself is fascinating and makes you want to look at this masterpiece for hours. So it is no wonder that in 2013 it was inscribed on the UNESCO Intangible Cultural Heritage List.

The tradition of decorating homes and clothes with decorative Petrykivka paintings originated in Ukraine long before the advent of Christianity. People believed that the beautiful ornaments contained a magical power that protected the owners from evil forces and adversity. That's why Zaporizhzhia Cossacks often painted weapons and huts with Petrykivka paintings as amulets.

The people whose houses were not painted with bright ornaments were not respected in the village, considering them morally poor and not even worthy of the greetings of their fellow villagers.

Here are some interesting secrets about Petrykivka painting: the main element of the painting is a flower (a symbol of lush nature). And the most interesting thing is that the brushes are made

independently - from cat hair cut from the chest, so the paint lays down smoothly and thinly, and sometimes the drawing is done with the fingers. Also, the paints are never mixed with each other.

Cossack songs of the Dnipropetrovs'k region.

Cossack songs were widespread throughout the region, as evidenced by folklore expeditions conducted in the early 2000s.

At that time, significant achievements in the preservation of Cossack songs were made in Novomoskovsk district (villages of Holubivka, Pishchanka, etc.); Pavlohrad district (villages of Kocherezhky, Bohuslav, etc.); Tsarychanka district (villages of Turove, Mohyliv, Tsybulkivka); Pokrovsk district (villages of Oleksiivka, Katerynivka, etc.) and a number of other districts.

“Cossack onces” are the songs that depict something: Cossack campaigns (e.g., ‘Oh, huk, mother, huk), Cossack leaders (e.g., the song ’Oh, from behind the mountain and also from behind the estuary”), Cossack lyrics (e.g., “From behind the mountains, from behind the mountains”), etc.

However, not all songs about Cossacks are Cossack songs. The Cossack theme was addressed by the authors of songs created during the years of the struggle for Ukrainian independence in 1917-1921, for example, the wans “A Cossack went to the war” or “A Cossack stands on a black cliff.”

Cossack songs are usually performed by a group and without the musical accompaniment; the songs are usually sung in a loud, rich sound and are often performed by women, with mixed groups being less common.

Conclusion: there is not a single multifunctional cultural center in Dnipro, so we decided to design one to become an important element of the city's development, education, and to preserve the cultural heritage of our region.

The center can become a platform for organizing cultural events such as exhibitions and workshops, a place for training and support for creative initiatives. We will be able to offer a variety of educational programs for both children and adults. It will contribute to the development of creative industries by providing space for artists,

musicians, and other creative people, as well as a platform for their performances or exhibitions.

REFERENCES

1. Havryliuk O. V. (2004). Folklore of Dnipropetrovs'k region: Cossack theme in songs. Kyiv: Institute of Folklore of the National Academy of Sciences of Ukraine.
2. Horlenko O.V. (2005). Petrykivka decorative painting. Kyiv: Nika-Center.
3. Grechanyk OL (2014). Petrykivka: Traditional painting as a phenomenon of Ukrainian culture. Dnipropetrovs'k: Dnipropetrovs'k National University.
4. Mykytenko L.O. (2010). Cossack songs of Dnipropetrovs'k region: Traditions and modernity. Dnipropetrovs'k: Dnipropetrovs'k National University.
5. Petrykivka painting: History and Traditions (2007). Exhibition catalog, Museum of Decorative Arts, Kyiv.
6. Petrykivka: Art that Impresses (2012). Dnipro: Lyra Publishing House.
7. Songs of the Cossack Era: Anthology of Folk Art (2011). Compiled by O. Kovalenko. Kyiv: Naukova Dumka.
8. Ryabchuk VM (2001). Ukrainian folk painting: technique and style. Kyiv: Naukova Dumka.
9. Skliarenko ML (2003). Traditional musical culture of Dnipropetrovs'k region. Dnipropetrovs'k: Promin.

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JUSTIFICATION FOR EDUCATIONAL PRACTICE AT THE INDUSTRIAL SITE OF STATE SPECIALIZED ENTERPRISE “CHERNOBYL NUCLEAR POWER PLANT”

As already known, a new educational program for Masters was launched at Ukrainian State University of Science and Technology (Educational and Scientific Institute) in 2024. It is called “Construction and Operation of Nuclear and Thermal

Energy Facilities." The program aims to prepare specialists in the design, construction, and maintenance of energy infrastructure objects. In this context, the educational practice is important because it helps students understand the program and its practical application better. That is why students are encouraged to visit the State Specialized Enterprise "Chernobyl Nuclear Power Plant" and familiarize themselves with the features of the building structures of the energy power units with HPCR (high-power channel reactor).

The operation of facilities includes not only their maintenance but also the potential dismantling in the future. Therefore, it is important to thoroughly understand their structure and technical characteristics. The station is visited by tourists from different countries. At the same time Ukrainian students, who have priority access to this knowledge, often remain excluded. They do not receive up-to-date information about the station's engineering structures and the educational practice aims to change this. The 5th and 6th power units are located on the territory of the State Specialized Enterprise "Chernobyl Nuclear Power Plant." They were not completed when they were put into conservation. This allows their structures to be studied from a distance without visiting the site. If there is sufficient justification, good preparation and necessary support educational practice can also be conducted at the site of the first and second power units of the plant.

Students of the construction field can visit the industrial site of the State Specialized Enterprise "Chernobyl Nuclear Power Plant" for educational practice only with special permits. Before the practice begins a program must be developed and approved by the relevant departments of the enterprise. During the practice students will learn about the construction of buildings. They will have the opportunity to familiarize themselves with the structures of the reactor compartment structures, the turbine workshop engine room, and other auxiliary buildings and structures. Students will also get acquainted with the cooling system facilities of the nuclear power plant, such as block pump stations, supply and exhaust channels, cooling towers, block pump stations for water supply to the cooling towers, etc.

Before the practice employees of the Chornobyl NPP give instructions. They explain the rules for staying at the site. Students must receive dosimetric devices. In the future, practice is planned at the 3rd and 4th power units of the Khmelnytska NPP. This is a branch of a separate division of JSC "National Nuclear Power Generating Company "Energoatom"" (JSC NNEGC "Energoatom"). Students will learn about the construction of power units with reactors of the WWER-1000 type (water-cooled water-moderated energy reactor).

REFERENCES

1. *ДСП «Чорнобильська АЕС»*. (n.d.) https://chnpp.gov.ua/ua/home.
2. СОУ НАЕК 100:2022 Інженерна, наукова і технічна підтримка. Інформаційні та керуючі системи, важливі для безпеки атомних електричних станцій. Загальні технічні вимоги. (2022).
3. СОУ НАЕК 190:2019 «Інженерна, наукова і технічна підтримка. Основні технологічні параметри АЕС з реакторами ВВЕР-1000. Норми точності вимірювань». (2019).

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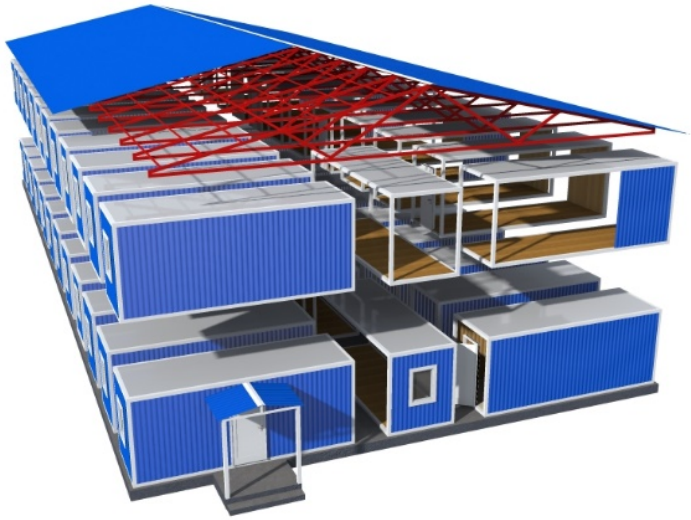
MODULAR CONSTRUCTION – MODERN TREND

There are a lot of innovative directions in construction and architecture nowadays. One of them is modular construction, which is gaining popularity all over the world and in Ukraine also. That's why I decided to look into this topic in detail.

Modular construction includes both the construction of entire buildings using prefabricated modules and the installation of fully finished modular buildings. These modules are equipped with electrical, plumbing, heating and internal fittings. Installed on the foundation, the modules are assembled to create full-fledged modular buildings, sometimes in a number of levels. [pic.1]



pic.1. Building made up of modules.

Depending on your needs and projects, possibilities are endless. Modular warehouses, cleaning booths, prefabricated warehouses, modular household solutions are becoming increasingly widespread on the market. Practical and easy to install, modular units can be used in many areas: offices, lighting, health care, factories, sanitary facilities. [1].

Modern realities in Ukraine require not only residential and commercial modular buildings, but also special military structures (for example long-term firing points), civil defense structures are also produced in modular form. [pic.2]

pic.2. Modular underground shelter.

First advantage of modular construction is low price compared to classic capital construction. It`s much easier and cheaper to buy and install modules, which was earlier made from steel, aluminum, wood, plastic, mineral wool, etc., than building house using concrete, bricks and other classic materials.

Second advantage of modular construction is that the design can be easily modified, several elements can be added, changed, replaced, if necessary, easily disassembled, transported to another location, and then collected or folded [2].

Operations with modular houses don`t require special construction equipment (except of small construction crane for lifting of modules) and don`t need a lot of workers on a jobsite. Modular construction allows you to transfer 95% of operations from the construction site to the plant, which leads to increasing quality of product [3].

Modular construction is the technology of the future and we need to improve it and implement it today.

REFERENCES

1. Fsantin. (2023, October 5). 7 benefits of modular construction - ABN Pipe Systems. ABN Pipe Systems. https://www.abnpipesystems.com/en/7-benefits-of-modular-construction/

2. *Home.* (n.d.). Modular Building Institute. https://www.modular.org/

3. Vanguard Modular, now BOXX Modular. (2020, August 13). *INCREDIBLE How Modular Buildings Are Built - The Modular Building Manufacturing Process.* YouTube. https://www.youtube.com/watch?v=PBHJ0OqPfm4

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HIGH PERFORMANCE GLASS

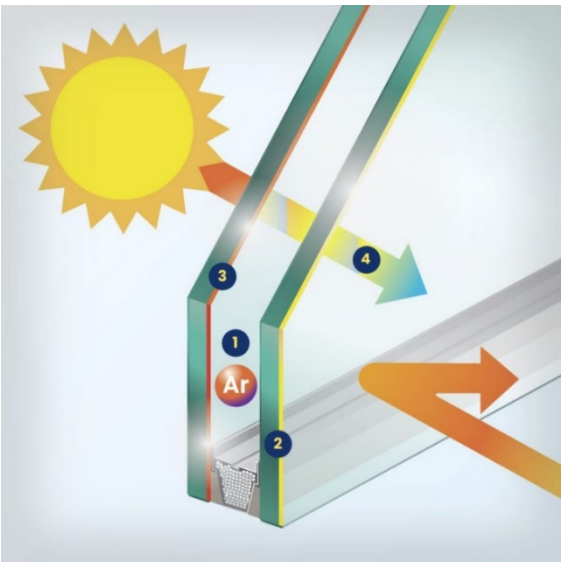
The objective of this article is to explore the significance and applications of High Performance Glass in modern architecture. By examining the latest advancements in glass technology, this work seeks to highlight how these innovative materials contribute to energy efficiency and sustainability in contemporary buildings. The discussion will encompass the diverse categories of high-performance glass, their respective benefits, and their impact on the creation of comfortable and environmentally responsible living and working spaces. Through this exploration I tried to provide architects, designers, and builders with a comprehensive understanding of the potential of high-performance glass in shaping the future of architectural design.

High Performance Glass and glazing systems are at the forefront of modern architecture, offering a perfect fusion of aesthetics and functionality. These advanced glass solutions are designed to meet the increasing demands for energy efficiency, durability, and visual appeal in contemporary buildings. By incorporating innovative technologies such as low-emissivity coatings, solar control films, and insulated glass units, high-performance glass can significantly reduce heat transfer, thereby lowering energy consumption and enhancing indoor comfort.

Moreover, these glass systems provide superior acoustic insulation, UV protection, and safety features, making them ideal for a wide range of applications, from residential spaces to commercial high-rises. As architects and designers continue to push the boundaries of what's possible, high-performance glass remains a main

component in creating sustainable, visually stunning structures that stand the test of time.

Insulated glass units (IGUs) are a critical component of high-performance glazing, representing a fundamental advancement in thermal insulation technology. These units consist of two or more panes of glass separated by a spacer frame, thereby creating a sealed insulating air layer. This design offers a substantial enhancement in thermal insulation, leading to significant energy savings and raise thermal comfort within buildings. To further optimize thermal performance, low-emissivity (Low-E) coatings are applied to glass surfaces. These coatings reduce the amount of heat that passes through the glass by reflecting infrared and ultraviolet radiation. This reduction in heat transmission contributes to maintaining a comfortable indoor temperature, enhancing the overall comfort level for users [1].



Picture 1: Texture of high-performance glazing

Besides, look at HPG Texture and Features (Picture 1):

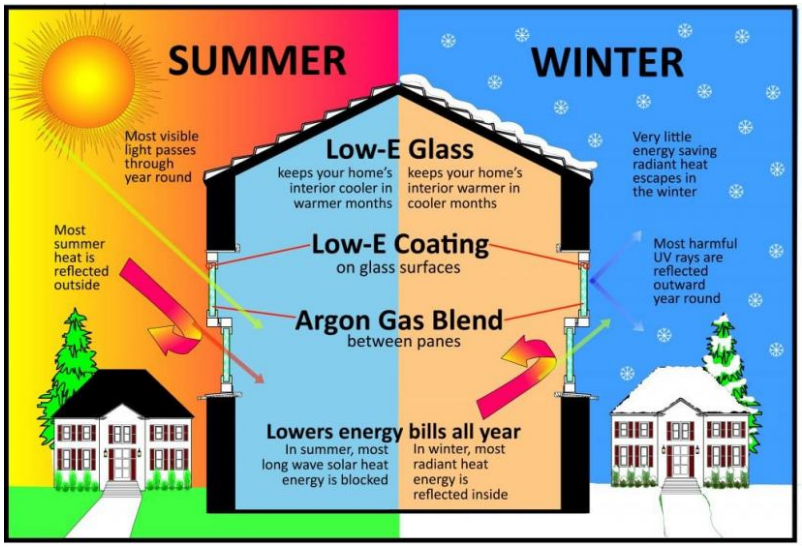
1. The glazing system consists of two panes of glass separated by a sealed space. This space is filled with argon gas, which is denser than air and provides enhanced insulation. The dual-pane configuration is engineered to reduce heat transfer, thereby enhancing energy efficiency.

2. The glass is treated with a Low-Emissivity (LoE3) coating, which is virtually invisible to the naked eye. This coating is engineered to reflect heat while allowing

light to pass through, ensuring that the glass maintains its clarity and transparency without compromising its thermal performance.

3. An additional LoE3 Clear Plus coating is applied to further enhance the glass's thermal properties. This coating is designed to prevent any loss of clarity, thereby preserving the glass's aesthetic appeal while providing superior insulation against heat and cold.

4. The High-Performance Double Glazing. Resulting in exceptional thermal insulation and energy efficiency, this is achieved through the combination of argon gas filling and advanced coatings. [2]



Picture 2: Energy saving works

This glazing system is designed to offer both functional benefits, such as energy savings and comfort, and aesthetic advantages, such as clarity and transparency, making it an ideal choice for modern architectural applications.

- Energy savings: the glass is engineered to reflect heat back to its source. This process contributes to the reduction of interior temperatures, particularly in residential settings, during summer months by reflecting a portion of the sun's heat energy back into the environment. A similar effect occurs during winter months, as the glass reflects interior heat back inside, thereby helping to maintain a comfortable indoor temperature. This making buildings more energy efficient (Picture 2) [3].

To summarize, high performance glass represents a significant advancement in glass technology, offering a range of benefits that make it an ideal choice for modern construction and industrial applications. HPG must play a bigger part as the need for energy-efficient solutions keeps growing.

REFERENCES

1. Civilex. (2023, October 19). High-Performance glass and Glazing Systems: revolutionizing architecture [Video file]. Retrieved from : https://www.youtube.com/watch?v=Yrl15Am7DCw
2. Columbia Manufacturing. (2022, August 2). Glass Tech. Retrieved from : https://energyefficientskylights.com/glass-tech/
3. Smarter Windows (2020, November 13). What is low-E glass? Retrieved from : https://www.smarterwindows.com/low-e-glass/

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OPTIMIZATION OF ORGANIZATIONAL AND TECHNOLOGICAL SOLUTIONS IN CONSTRUCTION AND GREEN BUILDING

In today's world, the construction industry is at a crossroads. Buildings not only form the backbone of modern civilization, but are also responsible for an astounding 38% of global energy consumption and related CO_2 emissions as of 2020 with the full life cycle, including material production, increasing global CO_2 emissions by up to 39% [6,7]. Extraction of raw materials for construction depletes the environment and has become a significant source of pollution [2]. If new technologies in construction

are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Program.

Optimization of construction processes and green building have common goals in terms of introducing innovative methods of managing the construction process, which reduces the consumption of energy and other resources [8]. This directly corresponds to the goals of green building, which is focused on the most efficient use of energy, materials, water and land resources [8]. The combination of these areas allows us to consider construction as a complex process, where optimization of management and technological solutions is a powerful tool for achieving environmental goals.

Today, building information modeling (BIM) is a significant factor influencing the energy efficiency of construction, as it integrates innovative technologies to optimize organizational and technological processes [8].

BIM modeling involves the evolution of traditional systems of building construction that includes various dimensions, each of which reflects a separate aspect of information, such as geometric information (3D), time (4D), costs (5D), environmental and energy sustainability (6D), facility management (7D), and construction safety (8D) [1]. This division allows for a clearer systematization and management of information, which is key to optimizing construction processes and making informed and effective decisions at all stages of design, construction, and operation.

A research performed by Spanish scientists Francisco Javier Montiel-Santiago, Manuel Jesús Hermoso-Orzáez and Manuel Jesús Hermoso-Orzáez analyzes the effectiveness of using BIM technologies at the 6D stage by developing a model that can automatically assess the energy efficiency and sustainability of a project, allowing designers to choose the best design option [5]. This paper investigates a specific construction project of an existing hospital, using a BIM model of the building to simulate its energy behavior and conduct an energy analysis. The purpose of this

approach is to preliminarily study the building's performance before possible reconstruction or rehabilitation measures [5].

In this study, a detailed architectural model was created using BIM REVIT, using dxf plans, which allowed for an accurate reproduction of the geometry of the object, its thermal envelope, and main operational characteristics. Further energy modeling was performed using the INSIGHT 360 plug-in, which runs in the cloud and uses proven modeling engines, including DOE 2.2 [3] and EnergyPlus [4], which provided accurate data on the current energy status of the facility. Finally, post-implementation analysis of the results obtained from the upgrades - replacing air conditioning systems with high-efficiency heat pumps, switching to LED lighting, improving window designs, and installing lighting control systems helped determine the effectiveness of the proposed improvements [5].

BIM modeling helps to perform a preliminary energy efficiency analysis and forecast energy consumption of a facility before construction begins. This ensures that informed decisions are made regarding the use of resources, improving building efficiency and reducing operating costs in the long run.

BIM modeling is only one of the many factors that contribute to the optimization of organizational and technological solutions in the construction industry. Other factors include team qualifications, choice of materials, construction technologies, regulatory requirements, environmental standards, etc. In our future research, we are planning to define the list of these factors in more detail and assess their significance using pairwise and multiple correlation. In particular, the shape of the building is important, as it determines the level of heat loss, energy efficiency, and comfort of the internal environment. The shape of the building also determines how large the external area of the enclosed structures (through which heat loss occurs) is relative to the internal volume of the building (which needs to be heated or cooled). In our future research, we want to analyze this in more detail and aim to identify the dependencies related to this ratio through calculations.

REFERENCES

1. Alcínia Zita Sampaio, Constantino, G. B., & Almeida, N. M. (2022). 8D BIM model in urban rehabilitation projects: Enhanced occupational safety for temporary construction works. Applied Sciences, 12(20), 10577. https://doi.org/10.3390/app122010577

2. Dhanasingh Sivalinga Vijayan. (2023). A state of review on instigating resources and technological sustainable approaches in green construction. Sustainability, 15(8), 6751. https://doi.org/10.3390/su15086751

3. DOE2.2. (n.d.). DOE2 building energy simulation. http://doe2.com/doe2/

4. EnergyPlus. (2020). Energy simulation software. https://energyplus.net/

5. Francisco Javier Montiel-Santiago, Hermoso-Orzáez, M. J., & Hermoso-Orzáez, M. J. (2020). Sustainability and energy efficiency: BIM 6D. Study of the BIM methodology applied to hospital buildings. Value of interior lighting and daylight in energy simulation. Sustainability, 12(14), 5731. https://doi.org/10.3390/su12145731

6. Global Alliance for Buildings and Construction. (2019). 2019 global status report for buildings and construction: Towards a zero-emissions, efficient, and resilient buildings and construction sector. https://globalabc.org/

7. United Nations Environment Programme (UNEP). (2020). 2020 global status report for buildings and construction: Towards a zero-emissions, efficient and resilient buildings and construction sector – Executive summary. https://globalabc.org/resources/publications/2020-global-status-report-buildings-and-construction

8. Wikipedia. (n.d.). Green building. In Wikipedia. Retrieved April 5, 2025, from https://en.m.wikipedia.org/wiki/Green_building

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HIGH-RISE BUILDINGS WITH LOAD-BEARING STRUCTURES MADE OF TUBECONCRETE

Since the second half of the 20th century, a trend has been observed in world construction practice towards the construction of multi-storey and high-rise buildings of frame and frame-connected structural systems. The construction of such buildings involves the use of high-strength, economical and safe-to-operate vertical load-bearing

structures, one of which is reinforced concrete. Today, metal pipes filled with concrete are widely used: in bridge construction or as columns in high-rise construction, or when arranging pit fences.

Reinforced concrete columns are often used on the lower, heavily loaded floors of high-rise buildings. Their high strength and rigidity allow you to reduce the cross-section of columns, maximizing the useful area, and in seismically hazardous regions to increase earthquake resistance due to their plasticity and ability to absorb energy [1].

Concrete in a tubular concrete column (hereinafter referred to as a TCC) is in conditions of triaxial compression and therefore the bearing capacity and deformability of tubular concrete during compression significantly increase. If we compare a tubular concrete column with a metal one, which has the same bearing capacity and weight, the reduction in metal consumption in the case of tubular concrete can reach 50%. If a reinforced concrete column is reinforced with the same amount of metal, then the TCC cross-section with the same bearing capacity can also be reduced to 50%.

Under the action of the load, the concrete tends to expand in the transverse direction, but the metal sleeve prevents the development of microcracks and creates conditions for the effective work of concrete. In turn, the concrete core, filling the metal shell of the pipe, increases its rigidity and resistance to general and local loss of stability [2].

The main disadvantage of TCC is the difficulty of ensuring the joint operation of the metal shell and the concrete core. The pipe begins to work as a sleeve under loads at which crack formation begins. The calculation of steel-reinforced concrete elements is performed according to [3].

A common way to ensure the joint operation of the core and the shell is to weld transverse rods (Nelson anchors) in the radial direction to the inner surface of the pipe. Another way to ensure the joint operation of the metal shell is to create a prestressing of the metal cage by using concrete on expanding cement. The high strength and deformability of compressed tubular concrete elements have their theoretical justification. When a compressive load is applied to a tubular concrete element, the

outer steel cage restrains the transverse deformations of the concrete core and takes on the lateral pressure from it. As a result, the concrete core operates under conditions of volumetric compression, and the steel cage is compressed in the longitudinal and radial directions and stretched in the tangential direction [4].

In the TCC, the axial and mutually perpendicular directions coincide with the directions of the main stress areas.

Then the expressions for determining the intensity of stresses σpi (formula 1) and strains εpi (formula 2) in a steel pipe can be written in the following form:

$$\sigma_{pi} = \frac{\sqrt{2}}{2}\sqrt{(\sigma_{pz}-\sigma_{p\tau})^2+(\sigma_{p\tau}-\sigma_{pr})^2+(\sigma_{pr}-\sigma_{pz})^2}\,, \qquad (1)$$

$$\varepsilon_{pi} = \frac{\sqrt{2}}{2(1-\mu_p)}\sqrt{(\varepsilon_{pz}-\varepsilon_{p\tau})^2+\varepsilon_{pz}{}^2+\varepsilon_{p\tau}{}^2}\,. \qquad (2)$$

,

where: σ_{pz}, $\sigma_{p\tau}$, σ_{pr} and ε_{pz}, $\varepsilon_{p\tau}$, ε_{pr} are the stresses and relative deformations of the pipe in the axial, tangential and radial directions, respectively.

At given axial deformations, the values of normal stresses in concrete and steel are determined at the points of contact of the steel pipe and the concrete core [5].

For this, the systems of equations (3) are solved jointly for each section:

$$\begin{Bmatrix}\varepsilon_{bz}\\ \varepsilon_{br}\end{Bmatrix} = \frac{1}{\nu_b E_b}\times\begin{bmatrix}1 & -2\mu_{zr}\\ -\mu_{zr} & (1-\mu_{rr})\end{bmatrix}\times\begin{Bmatrix}\sigma_{bz}\\ \sigma_{br}\end{Bmatrix};$$

$$\begin{Bmatrix}\varepsilon_{pz}\\ \varepsilon_{p\tau}\\ \varepsilon_{pr}\end{Bmatrix} = \frac{1}{\nu_p E_p}\times\begin{bmatrix}1 & -\mu_p & -\mu_p\\ -\mu_p & 1 & -\mu_p\\ -\mu_p & -\mu_p & 1\end{bmatrix}\times\begin{Bmatrix}\sigma_{pz}\\ \sigma_{p\tau}\\ \sigma_{pr}\end{Bmatrix}.$$

$$\nu_b = \nu_{bu} \pm (\nu_0 - \nu_{bu})\sqrt{1-\omega_{1b}\eta_b - \omega_{2b}\eta_b^2}$$

For numerical analysis of the stress-strain state of tubular concrete elements under the action of axial compressive load, taking into account eccentricities, the finite element method is used.

Conclusions

Tuboconcrete structures are very reliable in operation. In the limit state, they do not lose their bearing capacity instantly, like reinforced concrete, and are still able to withstand loads for a long time. Numerous experiments by scientists have established

that, receiving large deformations, a concrete tube core continues to bear a significant load. Therefore, the use of tuboconcretein combination with high-strength concrete can affect industrial, civil and transport construction in Ukraine during the recovery years.

REFERENCES

1. Confinement Effect of Concrete-Filled Steel Tube Columns With Infill Concrete of Different Strength Grades.URL:https://www.frontiersin.org/journals/materials/articles/10.3389/fmats.2019.00071/full

2. Ovchynnikov, I. I., Ovchynnikov, I. H., Chesnokov, H. V., Mikhaldykin, Ye. S. Pro problemu rozrakhunku trubobetonnykh konstruktsii iz obolonkoiu z riznykh materialiv. Chastyna 1. Dosvid zastosuvannia trubobetonu z metalevoiu obolonkoiu. URL: https://elima/articles/?id=177

3. DBN V.2.6-160:2010. (2010). Stalezalizobetonni konstruktsii. Osnovni polozhennia. – Kyiv: Minrehionbud Ukrainy.

4. What is reinforcement concrete. URL: https://www.wrightminimix.co.uk/news/what-is-reinforced-concrete#:~:text=It%20combines%20concrete's%20compressive%20strength,a%20variety%20of%20forces%2C%20including

5. Key Therm – Composite Aktion. URL: https://fiveable.me/key-terms/introduction-civil-engineering/composite-action

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ANALYSIS OF CONCRETE PERFORMANCE UTILIZING LOCALLY SOURCED MATERIALS IN LIGHTWEIGHT PERMANENT FORMWORK SYSTEMS

Introduction. Ukraine faces an unprecedented reconstruction challenge: over 236 000 residential buildings have been damaged or destroyed, generating more than 700 000 tons of debris in the wake of Russia’s large-scale invasion. Traditional

rebuilding methods are thwarted by labor shortages, damaged logistics, and budgetary constraints. This study proposes a sustainable, rapid-reconstruction approach that leverages abundant local byproducts like granite screenings and blast-furnace slag to manufacture lightweight, permanent formwork blocks. By integrating resource reuse with simplified assembly, the research aims to reduce costs, minimize waste, and accelerate post-conflict rebuilding efforts[1-3].

Materials and Methods. Sourcing from the Dnipropetrovsk region's extensive granite quarries and metallurgical plants, two concrete mixtures were prepared: (1) 1:2:2 by weight of cement, sand, and granite screenings; and (2) 1:2:2 cement, sand, and metallurgical slag. A total of 54 cubic specimens (100 mm^3) and eight prisms (100×100×400 mm and 70×70×280 mm) were cast and cured for 28 days. Standardized testing assessed compressive strength, flexural strength, and Young's modulus. Dimensional consistency was verified via Pearson correlation coefficients. Concurrently, finite element modeling in ANSYS examined block geometry for a representative beam (250 × 300 × 600 mm with 20 mm wall thickness), targeting a mass below 25 kg to permit single-person handling.

Experimental Results. Granite-based specimens exhibited compressive strengths of 9.5-11 MPa, flexural strengths of 2 MPa, and mean Young's modulus of 23×10^3 MPa. Slag-based cubes achieved an average compressive strength of 9.5 MPa, flexural resistance of 2 MPa, and a Young's modulus of 21×10^3 MPa. In all cases, dimensional measurements produced Pearson correlation coefficients are close to unity, confirming uniformity in mixture preparation and curing processes. These mechanical properties meet the baseline requirements for moderate-load bearing applications in formwork contexts.

Numerical Modeling. Finite element simulations have corroborated the laboratory findings and have validated block design. Under simulated service loads, the beam model has displayed a maximum deflection of only 0.02 mm negligible relative to wall thickness and peak stress of 1.06 MPa, roughly 50% of the measured flexural capacity. Stress contours have indicated uniform distribution without critical

concentration, underscoring a comfortable safety margin. These results confirm that the proposed block geometry is structurally robust while remaining lightweight.

Formwork Block Design. Building material insights and numerical validation, modular formwork blocks were developed for columns and beams. Columns: Two standard heights (300 mm and 600 mm) employ a tongue-and-groove joint for precise alignment, reinforced by a simple clamping system using steel angle profiles and adjustable bolts. This design ensures vertical accuracy without specialized tools or training. Beams: U-shaped beam blocks incorporate side-wall reinforcement and a lightweight support scaffold to maintain positional stability during concrete placement and curing. Both block types remain under 25 kg, enabling field assembly by one or two workers.

Discussion. The integration of locally sourced aggregates and innovative block geometries demonstrates a viable pathway for cost-effective, sustainable reconstruction. Granite screenings offer slightly higher stiffness, whereas slag provides a circular-economy advantage by diverting industrial waste from landfills. The reduced need for mechanical equipment and the simplified assembly process address labor constraints typical in post-conflict zones. Moreover, local material utilization cuts transportation costs and carbon emissions, aligning with broader sustainability goals.

Conclusions and future work. This study validates the mechanical suitability of granite- and slag-based concretes in permanent formwork applications and confirms the structural integrity of the proposed block designs through both laboratory testing and finite element analysis. Ongoing research will focus on field trials to assess real-world installation efficiency, labor requirements, and long-term performance under variable environmental conditions. This approach holds promise for rapidly restoring resilient housing and infrastructure in Ukraine’s most affected regions by marrying resource reuse with user-friendly construction methods.

REFERENCES

1. Jadwiga Rogoża – Ukraine in the face of a demographic catastrophe, 2023

2. Judith Kohlenberger, Isabella Buber-Ennser, Konrad Pędziwiatr, Bernhard Rengs, Ingrid Setz, Jan Brzozowski, Bernhard Riederer, Olena Tarasiuk, Ekaterina Pronizius – High self-selection of Ukrainian refugees into Europe: Evidence from Kraków and Vienna, 2023

3. Kyiv School of Economics – Damages to Ukraine's infrastructure due to the war have risen to $170 billion – KSE Institute estimate as of November 2024

4. Nilimaa, J.; Gamil, Y.; Zhaka, V. Formwork Engineering for Sustainable Concrete Construction. CivilEng 2023, 4, 1098-1120. https://doi.org/10.3390/civileng4040060

5. Yang, Yibo & Chen, Baixi & Chen, Yong & Zhou, Huanyang & Liu, Fucai & Xie, Xiangming & Chen, Junsheng & Guo, Wenying & Wang, Hengchang. (2023). Performances of Concrete Columns with Modular UHPC Permanent Formworks Under Axial Load. International Journal of Concrete Structures and Materials. 17. 10.1186/s40069-023-00608-1.

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ZERO LIQUID DISCHARGE TECHNOLOGIES FOR WASTEWATER TREATMENT: CURRENT STATUS AND DEVELOPMENT TRENDS

In the current context of increasing water resource scarcity and tightening environmental regulations, technologies aimed at minimizing water consumption and reducing the volume of wastewater discharges into natural water bodies are gaining particular importance. One of the promising directions in this field is the implementation of Zero Liquid Discharge (ZLD) systems, which ensure complete utilization of wastewater or its reuse after advanced treatment [1-2]. The development of such technologies opens new opportunities for sustainable water use in industry and municipal sectors.

Zero liquid discharge technologies involve an integrated approach to wastewater treatment, aiming at the maximum removal of impurities and the return of purified water into production cycles. A typical ZLD scheme includes stages of

physicochemical treatment, the application of membrane methods (reverse osmosis, nanofiltration), and evaporation of residual concentrates [3].

Currently, the practical implementation of ZLD systems covers the following key technologies: preliminary treatment by mechanical and physicochemical methods; membrane processes for high-efficiency water recovery [4]; evaporative units and crystallization systems for concentrate disposal [1]; and technologies for recovering valuable substances from wastewater [3].

Such technologies are being realized within closed cycles at enterprises in the energy, textile, chemical, and pharmaceutical industries. ZLD systems are being particularly actively implemented in regions with limited water resources, such as India, China, and South Africa [2].

However, the widespread deployment of ZLD technologies faces several limitations, including high capital and operational energy costs [1]; the complexity of managing salt balance [4]; and the need for highly qualified system maintenance personnel.

Therefore, further advancement of ZLD technologies depends directly on reducing operational costs and increasing energy efficiency.

The use of zero liquid discharge technologies is critically important not only for resource conservation but also for reducing the environmental burden on natural ecosystems. Traditional wastewater treatment methods, even those providing a high degree of purification, do not always guarantee complete removal of contaminants such as heavy metals, residual pharmaceuticals, and microplastics. ZLD systems allow the almost complete elimination of harmful discharges into the environment, contributing to the restoration of ecological balance in water bodies.

The implementation of ZLD systems is particularly relevant in regions with high population density and limited water resources. In such conditions, water purification and reuse not only reduce anthropogenic impacts but also become essential prerequisites for the socio-economic stability of territories.

Moreover, modern ZLD technologies actively contribute to the achievement of the UN Sustainable Development Goals, particularly Goal 6 («Clean Water and Sanitation») and Goal 12 («Responsible Consumption and Production»). This underlines the importance of a systematic approach to the implementation of ZLD systems at all levels — from local industrial facilities to national water management strategies.

Among the priority directions for improving ZLD technologies are: the development of new generations of membrane materials with enhanced resistance to fouling and longer service life [4]; the advancement of energy-efficient evaporation technologies with heat recovery [1]; the integration of membrane and biological treatment processes into hybrid systems [3]; the application of automated monitoring and control systems; and the development of innovative methods for the disposal of solid residues and concentrates with the potential for their reuse as resources [5].

Special attention is also given to the deployment of digital control technologies, including the use of artificial intelligence algorithms for the optimization of complex closed water systems.

Zero liquid discharge technologies for wastewater treatment are a key tool in strategies for sustainable water use. Their development contributes to reducing the environmental load, conserving water resources, and creating new opportunities for integrating the principles of the circular economy into the water sector. Despite existing technical and economic challenges, improvements in membrane, evaporation, and hybrid technologies create prerequisites for the widespread adoption of ZLD solutions across all sectors of economic activity [2-3].

REFERENCES

1. Mickley, M.C. (2008). Zero Liquid Discharge: Desalination Technology and Economics. WaterReuse Foundation.

2. Tchobanoglous, G., Burton, F.L., Stensel, H.D. (2014). Wastewater Engineering: Treatment and Resource Recovery. McGraw-Hill Education.

3. Shon, H.K., Phuntsho, S., Chaudhary, D.S., Vigneswaran, S. (2016). Resource Recovery from Water: Principles and Applications. CRC Press.

4. Lattemann, S., Höpner, T. (2008). Environmental Impact and Impact Mitigation in Seawater Desalination. Desalination.

5. Glazunov, V.G. (2013). Technologies for the Treatment of Natural and Wastewater. Kharkiv: NTU «KhPI».

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THE USE OF FINITE ELEMENT METHOD IN THE STABILITY ANALYSIS OF CYLINDRICAL TANKS

Problem Statement. Steel vertical cylindrical low-pressure tanks are commonly used as storage vessels for water, petroleum products, and gases. Due to the current military actions, many such structures have sustained significant damage or have been completely destroyed. This situation necessitates the urgent construction of new tanks.

The cylindrical shell wall serves as the primary load-bearing element of the tank. It belongs to the class of thin-walled shells, with the following typical geometric ratios: $r/t = 600 \div 3800$; $l/r = 0.6 \div 2.5$, where l, r, and t denote the shell's length, radius, and thickness, respectively. Stability becomes a critical design concern for such structures.

Among compressive loading scenarios, wind pressure plays a major role. According to design standards [1, 2], wind loading on cylindrical structures is considered as pressure that is unevenly distributed along the circumference.

In the general case, the stability problem for a cylindrical shell under external pressure is described by an eighth-order differential equation. Analytical solutions to this problem are quite cumbersome and impractical for engineering applications. A viable alternative to analytical approaches is the finite element method (FEM), which is based on the classical principles of structural mechanics. This method enables

solving complex mechanical problems while accounting for all structural features of the system and the specifics of applied loads.

Accordingly, in this study, the stability analysis of a cylindrical shell under external pressure is carried out using the LIRA software suite, which implements the finite element method.

Research Objective. The purpose of this work is to determine the optimal finite element model for cylindrical shells subjected to external pressure.

Research Content. Finite element analysis of the shells was performed using flat shell elements KE 41 and KE 341. The geometric characteristics of the shell are approximated by the geometry of an inscribed polyhedron. As the finite element mesh is refined, the approximation accuracy of the shell surface using flat elements improves. Hence, convergence of the FEM solution is ensured.

As noted in [4], the meshing operation – i.e., the subdivision of the structure into finite elements – is difficult to formalize. At the initial stage, an arbitrary meshing pattern was applied. The number of elements along the circumference was set as a multiple of the number of buckling waves corresponding to the critical mode under external pressure. The number of elements along the height was chosen to maintain equal element dimensions.

Parametric modeling was carried out with variations in the geometric characteristics of the shell in order to investigate their influence on the critical pressure, and a sensitivity analysis was performed to assess the effect of changes in the loading model and boundary conditions [3]. In particular, the r/t ratio was varied within the range of 600 to 3800, which made it possible to identify the limiting values required to ensure stability under different tank configurations. The sensitivity analysis of the model to boundary conditions (such as rigid clamping of the bottom edge or hinged support) allowed for the evaluation of the impact of support type on the shell's stability.

A stability analysis was conducted for the selected mesh, and the critical pressure values were determined. The mesh was then refined, and the calculation repeated. This

process continued until the difference between two successive results did not exceed 5%. The mesh at this point was considered the optimal one for further analysis.

Conclusions.

1. The conducted study confirmed that the LIRA software suite, which implements the finite element method, is an effective tool for analyzing the stability of thin-walled cylindrical shells under external pressure. Its computational capabilities allow for the consideration of geometric features, loading types, and boundary conditions, making it suitable for practical design applications of storage tanks.

2. The use of flat shell elements KE 41 and KE 341 in this task proved to be justified. The analysis showed that with sufficient mesh refinement, the approximation accuracy of the curved shell surface is satisfactory, and the resulting calculations are reliable.

3. A mesh refinement strategy was developed based on successive iterations and convergence control. The mesh was considered optimal when the relative difference between two consecutive results did not exceed 5%.

REFERENCES

1. Ministry of Construction of Ukraine. (2006). Loads and actions. Design standards (DBN V.1.2-2:2006). Kyiv: Minbud Ukrainy. (Original work published in Ukrainian).

2. Ovcharenko, V. A., Podlesnyi, S. V., & Zinchenko, S. M. (2008). Fundamentals of the finite element method and its application in engineering calculations: A textbook. Kramatorsk: Donbas State Machine-Building Academy. (Original work published in Ukrainian).

3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt. (2001). Concepts and Applications of Finite Element Analysis, 4th Edition-Wiley.

4. State Committee on Oil and Gas of Ukraine. (1994). Vertical steel tanks for storage of oil and oil products with saturated vapor pressure not exceeding 93.3 kPa: Departmental building standards of Ukraine (VBN V.2.2-58.2-94). Kyiv: Derzhkomnaftohaz. (Original work published in Ukrainian).

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ARCHITECTURAL REVITALIZATION: CREATING A NEW URBAN SPACE ON THE SITE OF AN INDUSTRIAL ZONE

Revitalizing industrial cities is an important way to improve modern cities. It allows cities to reintegrate old industrial areas that have been abandoned or not used properly back into the larger urban space. Cities like Dnipro, with a long industrial history, must emphasize revitalization due to many large industrial sites that are empty or have no purpose. Within the context of revitalization in Dnipro lies the goal of moving factories further from the Dnipro River and creating new spaces to support sustainable urban growth..

Is Revitalization Necessary? What Happens If Nothing Changes?

If industrial land maintains the status quo, the impacts can be quite deleterious:

Environmental problems – the effect of past industrial activities polluting the land, water, and air.;

Urban barriers – sites that block access to parks and the river;

Economic stagnation. – unused land does not attract investment.;

Social problems – abandoned areas can lead to crime and lack of public spaces.

There are some additional benefits to revitalization:

progressive uses of urban land have generally been developed for residential, mixed use commercial, and recreational that are useful to contemporary cities;

improvement of environmental conditions from cleaned up soil, reduction in industrial land use;

more meaningful growth – opportunities for growth from outside investment vs remarkably supporting small large business growth that will provide up income to greater than conventional use of land;

create whole cloth new identity – an intrinsic change to the image of Dnipro; for community residents, tourists, government offices, and businesses.

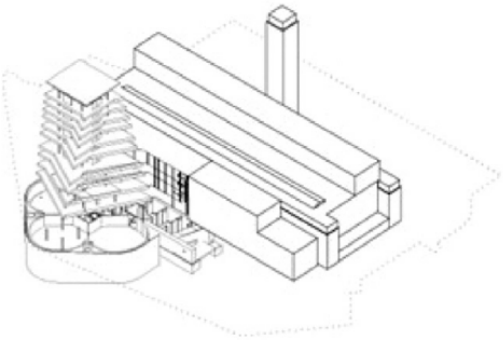
Analysis of Industrial Zones in Dnipro. Dnipro has a long history of being an industrial city, with many factories sited along the river as they needed water for the production process. However, due to economic changes, many factories have closed, and some portions of their land are empty or abandoned. The areas to be focused on for industrial revitalization comprise:

Dnipro Metallurgical Plant, Dnipro Machine-Building, Plant Industrial areas along Peremohy Embankment.

International Experience in Revitalization. We should analyze the experience and the situation in the cities:

HafenCity (Hamburg, Germany) - the transformation of old port areas into an attractive area for residential and business use.

Tate Modern (London, United Kingdom) - the repurposing of a former power station to become one of the top art centres in the world.



High Line (New York, USA) - repurposing the old, unused rail corridor into a modern urban park.

Conclusion

Revitalizing industrial areas in Dnipro is an important part of the city's future. Creating public spaces where old factories were will make the city bigger and better. It will also bring new businesses, new jobs, and better social life. There are many successful examples in other countries. This kind of project can show how to build and use empty industrial places. It can help Dnipro have a new modern city identity..

REFERENCES

1. HafenCity Hamburg GmbH. (n.d.). HafenCity Project Overview. Retrieved April 16, 2025, from https://en.wikipedia.org/wiki/HafenCity

2. Tate. (n.d.). Tate Modern – History of the Gallery. Retrieved April 16, 2025, from https://en.wikipedia.org/wiki/Tate_Modern

3. High Line. (n.d.). The High Line – About the Park. Retrieved April 16, 2025, from https://en.wikipedia.org/wiki/High_Line_(Manhattan)

4. UN-Habitat. (n.d.). Urban Regeneration – Sustainable Development in Cities. Retrieved from https://unhabitat.org/topic/urban-regeneration

5. Barabanov, A. A. (2013). Socio-cultural and semantic principles of revitalization of industrial heritage. Eco-potential, (3–4), 237–248.

6. Kiseleva, E. (2014, April 16). The essence of the matter: Revitalization or redevelopment? Vedomosti. Retrieved March 18, 2017. Archived April 3, 2017.

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THE SIGNIFICANCE OF SUSTAINABLE WATER MANAGEMENT IN CONSTRUCTION AND ARCHITECTURE

1. Overview: Water as the Basis for Sustainable Design and Life

Water, which makes up more than two-thirds of the earth's surface, is vital to ecosystems, human survival, and the built environment. Only a small portion of it is accessible freshwater, though? the growing demands due to pollution, urbanization, and climate change are making water scarcity worse. This circumstance necessitates rethinking how water is used in building and architecture. There is a great deal of space for improvement as the building industry has a major impact on global water consumption, particularly through the use of potable water. Top priority in sustainable design should be given to ecosystem support, efficiency, and conservation. Localized, culturally appropriate water strategies that honor the environment and the community can result from fusing traditional knowledge with contemporary innovation.

2. Water-Sensitive Urban Design and Sustainable Architecture

2.1 Stormwater management and rainwater harvesting

Rainwater harvesting is commonly incorporated into modern architecture to lessen reliance on municipal resources. In order to control runoff and lessen urban flooding, features like bioswales, permeable pavement, and green roofs are being utilized more and more. For example, Singapore's urban planning initiatives creatively blend beautiful design with stormwater management. Real-time tracking of water quality and performance is now possible thanks to smart monitoring systems, guaranteeing safe reuse and effective operation. By increasing humidity and decreasing

heat, this type of green infrastructure also enhances regional microclimates.

2.2 Closed-loop systems and greywater recycling

Systems that purify greywater, or water from sinks, showers, and laundry, for use in irrigation and flushing are becoming more and more common in buildings. This is possible even in urban settings thanks to technologies like membrane bioreactors (MBRs) and artificial wetlands. The Bullitt Center in Seattle is a prime example, having combined on-site treatment and rainwater collection to achieve net-zero water use. In addition to promoting urban biodiversity through natural treatment ecosystems, recent advancements have reduced the energy footprint of these systems, making them suitable for a greater variety of building types.

2.3 Design That Responds to Climate

Passive techniques like wind towers, drought-resistant landscaping, and evaporative cooling can significantly reduce water demands in areas with limited water supplies. Many of these methods have their roots in traditional knowledge and are currently being modified to incorporate modern technologies. One example is the use of ancient Persian qanats for groundwater management. By using thermally massive materials like rammed earth and adobe, indoor humidity can be naturally controlled, lowering the need for mechanical systems. These methods can drastically reduce building water use when applied carefully.

3. Eco-Friendly Materials: Cutting Down on Water Use in Building

3.1 Materials with Minimal Water Impact

Choosing building materials that use as little water as possible over the course of their life cycle is part of sustainable construction. Eco-friendly substitutes include repurposed steel, reclaimed wood, and quickly renewable materials like hemp or bamboo. In addition to providing structural advantages, engineered materials such as cross-laminated timber (CLT) have smaller water footprints than conventional concrete. Mycelium and plant fiber insulation are examples of emerging bio-based

materials that can further lower resource intensity while promoting healthy indoor environments.

3.2 Materials That Are Permeable and Hygroscopic

Rainwater can replenish groundwater instead of generating runoff when permeable concrete and porous asphalt are used. In a similar vein, hygroscopic materials that draw moisture from the atmosphere can lessen the requirement for irrigation in green walls or façades. Systems that collect water from dew or humidity are among the innovations in this field; these are particularly useful in semi-arid or coastal settings.

3.3 Using Circular Construction Techniques

Because they save water, prefabricated and modular construction methods are becoming more and more popular. These techniques generate less waste and eliminate the need for on-site water-intensive procedures. Furthermore, effective dust suppression techniques, like atomized mist, require less water than conventional hosing, which helps to promote more water-conscious building practices in general.

4. Membrane Technologies: Advances in Water Treatment at the Building Scale

Water management in buildings is being revolutionized by membrane-based water treatment systems. Greywater and rainwater can now be treated and reused on-site thanks to technologies like forward osmosis (FO), nanofiltration (NF), and reverse osmosis (RO).

• Biomimetic membranes, which draw inspiration from natural processes, are making RO systems more energy-efficient.

• NF membranes are helpful for high-purity reuse because they can eliminate micropollutants that other systems overlook.

• FO technology provides an energy-efficient method of treating and concentrating wastewater; hybrid systems are now combining RO and FO for improved efficacy.

These systems are becoming more practical for both residential and commercial buildings as they are improved and expanded.

Barriers like cost, public awareness, and regulatory inertia still exist despite tremendous progress.

5. Conclusions.

Urban resilience and sustainable design both heavily rely on water. Architects and engineers can rethink how buildings engage with the hydrological cycle by combining regenerative materials, efficient technologies, and conventional wisdom. Smart water systems that track usage, identify leaks, and improve flow using Internet of things sensors to ensure responsible development, it is crucial to teach aspiring professionals about water-sensitive design. In the end, structures should actively support the health of the water in their surroundings in addition to minimizing damage.

REFERENCES

1. Ministry of Construction of Ukraine. (2006). Loads and actions. Design standards (DBN V.1.2-2:2006). Kyiv: Minbud Ukrainy. (Original work published in Ukrainian).
2. Wikipedia. https://en.m.wikipedia.org/wiki/Water
3. The U.S. Geological Survey. https://www.usgs.gov/special-topics/water-science-school/science/water-you-water-and-human-body

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QUANTITATIVE METHODS FOR ASSESSING THE QUALITY OF URBAN TERRITORY

Today, cities are growing and expanding, overpopulating their central parts, and making transport links more difficult. Urban development is becoming disconnected from the natural environment, and the urban population is overly concentrated. There

is a growing mismatch between the principles of urban planning and the new conditions of development. In these conditions, it is important to study methods for assessing the quality of urban areas.

As pointed out by Y. Hubar and V. Say, the main task of the valuation is to identify the characteristics that affect the prices of objects, taking into account certain factors. The factors of urban area valuation include:

1) environmental factors (air pollution, noise pollution);

2) localisation factors: infrastructure (availability of engineering equipment on the territory), engineering and geological factors (groundwater, soil bearing capacity), physical and geographical indicators (relief);

3) communication factors (conditions of transport communication, transport accessibility) [1].

Another specialists in this field P. Sankov and V. Gilev, investigated the patterns of influence of architectural and urban planning, environmental, organisational and technological factors on the quality and safety of human life in a modern city. The territory can be examined by the following factors: natural and climatic environment, ecological and hygienic environment, living environment, industrial environment, recreational environment and socio-psychological environment. The basis for assessing the quality of an urban area is to compare the obtained qualitative values of the factors with theoretically optimal values and norms [2].

O. Tsyganenko believes that the assessment of the city territory should include the following groups of factors:

1) natural conditions and resources (relief, soils, resources, land, minerals, etc.);

2) the current state of economic development (housing stock, cultural and consumer services, engineering and transport infrastructures, level of amenities, etc.);

3) social conditions (population, places of work, places of recreation);

4) environmental conditions (level of air pollution, water pollution, soil pollution, presence of electromagnetic waves, noise, radiation pollution);

5) architectural and aesthetic conditions (presence of nature reserves, monuments of architecture and urban planning, archeology, history, nature, culture) [3].

Thus, assessment of the urban quality of an urban area can become an important step in preparing a social, environmental and economic development strategy for the city. It should be used to develop planning solutions to assess differences in the natural and economic characteristics of individual parts of the territory, areas of functional zoning and models of possible economic development.

REFERENCES

1. Губар, Ю., Сай, В., Винарчик, Л. (2020). Методика містобудівного моделювання масової оцінки земель. *Сучасні досягнення геодезичної науки та виробництва*. 1 (39). 128-138.
2. Саньков, П. М., Гільов, В. В., Ткач Н. О., та інші. (2023). Методики оцінки якості життєдіяльності людини сучасного міста. Дніпро : ПДАБА.
3. Циганенко, О. (2014). Застосування комплексної соціально-економічної оцінки території для розробки соціо-еколого-економічних стратегій розвитку міста. *Інвестиції: практика та досвід*. 7. 116-120.

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THE ROLE OF SCADA IN MANAGING HVAC SYSTEMS

Large facilities often operate multiple automated ventilation units and heating, ventilation, and air conditioning (HVAC) systems. Implementing a dispatch control system is essential for their coordinated and efficient operation. This approach enables centralized control, equipment status monitoring, and remote management via the Internet [Mistry, 2023; Widura, 2022].

Dispatch control provides centralized oversight of processes at large facilities and enables adjustment of service equipment parameters. Data is collected and processed by programmable logic controllers (PLCs) that support various communication standards.

Typically, implementation starts with local subsystems and then gradually expands to cover the entire facility. To avoid compatibility issues or functional limitations from early-stage solutions, it is essential to plan the system comprehensively from the start, using SCADA (Supervisory Control and Data Acquisition). SCADA systems offer centralized monitoring, automatic data acquisition, event logging, and remote control via Internet-connected interfaces [Popa, 2024].

The implementation of the dispatching system improves equipment efficiency, optimizes resource consumption, maintains comfortable conditions in real time, and enables data accumulation for system performance analysis and forecasting. An additional protocol converter – for example, the USB-CON by TM “TENSE” (Tense Elektronik) – is required for integrating climate control equipment into the dispatching system.

The USB-CON protocol converter, produced by Turkish manufacturer TENSE, is a compact device for connecting RS232/RS485 (MODBUS) interface-equipped devices to a computer via USB. (Fig. 1) [Tense Elektronik, n.d.].

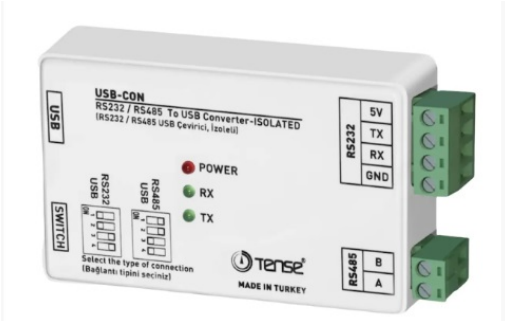

Figure 1 RS232/RS485 to USB converter

The connection diagram of devices to the USB converter, illustrating its use within the dispatching system, is presented in Figure 2.

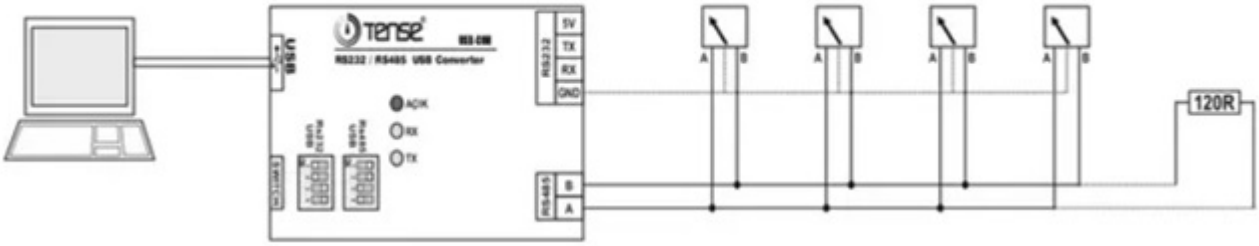

Figure 2 Devices connection diagram using the USB-CON converter

The SCADA system integrates all HVAC components into a unified controlled network, enhancing energy efficiency, reducing consumption, and improving overall economic performance. By combining various controllers and utilizing standard communication interfaces along with specialized software, the system provides centralized control and real-time monitoring of climate control equipment [Widura, 2022].

The topological structure of the SCADA system, illustrating the arrangement of devices, sensors, controllers, and other components within a unified control environment, is presented in the topological diagram (Fig. 3). This structure is essential for understanding the organization of the network and ensuring system reliability.

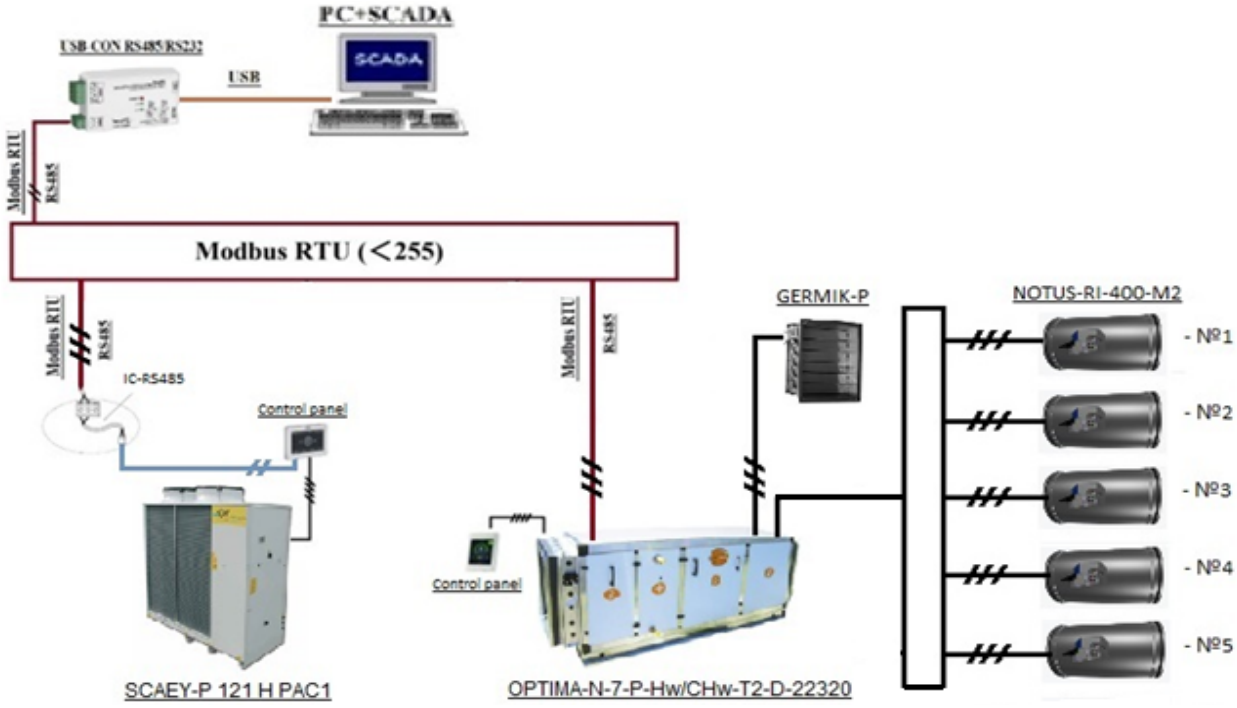

Figure 3 The topological structure of the SCADA system

In conclusion, the flexibility of SCADA architecture makes it a robust solution for both new HVAC installations and the modernization of existing infrastructure. Its ability

to support scalability, integrate diverse equipment, and adapt to technological advancements ensures long-term operational efficiency and compliance with evolving regulatory standards. Thus, SCADA-based dispatch control systems represent a critical component in the effective management of modern climate control environments.

REFERENCES

1. Mistry, V. (2023). Energy Efficiency in HVAC Systems through Building Automation. *Journal of Biosensors and Bioelectronics Research*, *1*(1), 1–4. https://doi.org/10.47363/JBBER/2023(1)113

2. Popa, L. (2024). Study on designing an automated system of efficient HVAC control for energy saving in industrial buildings. *ResearchGate*. https://www.researchgate.net/publication/327730981_Study_on_designing_an_automated_system_of_efficient_HVAC_control_for_energy_saving_in_industrial_buildings

3. Tense Electronics. (n.d.). USB-CON | RS232/RS485 to USB Converter. *Tense Electronics.* https://tense.com.tr/en/products/rs232-rs485-to-usb-converter-usb-con/

4. Widura, A. (2022). Energy-Saving in Air Conditioners Using PLC Control and the SCADA Monitoring System. ECTI Transactions on Electrical Engineering, Electronics, and Communications. https://www.academia.edu/122246271/Energy_Saving_in_Air_Conditioners_Using_PLC_Control_and_the_SCADA_Monitoring_System

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MAISONS FLOTTANTES, AVANTAGES ET PERSPECTIVES DE CONSTRUCTION

Énoncé du problème. La nécessité d'une recherche approfondie sur les maisons flottantes en tant que solution potentiellement efficace et durable pour relever les défis liés au changement climatique, aux ressources foncières limitées et au besoin de développement innovant d'infrastructures résidentielles et commerciales, ainsi que d'identifier les moyens de surmonter les obstacles techniques, réglementaires et sociaux existants à leur adoption généralisée.

Objectif de l'étude. L'objectif de l'étude des bâtiments flottants est de prouver les perspectives du développement de la construction des logements sur l'eau en Ukraine. Selon le Groupe d'experts intergouvernemental sur l'évolution du climat (GIEC), le niveau de la mer pourrait augmenter de 59 cm d'ici 2100 et une étude de la NASA de 2017 montre que la glace autour du Groenland et de l'Antarctique fond plus rapidement. Pour lutter contre ces menaces, des architectes et urbanistes ont conçu des îles flottantes et même des villes sur l'eau. Les Néerlandais sont les leaders dans ce domaine. Dans la ville de Maasbomel, les équipes de construction de Vermeer ont construit 50 maisons flottantes qui peuvent s'élever jusqu'à 5,5 mètres au-dessus de leur position d'origine à marée haute tout en restant au sec à l'intérieur. [1]

Vous pouvez également utiliser des péniches comme logement, cela peut être très pratique, mais on peut y avoir de nombreux problèmes avec la transformation et l'aménagement intérieur. Bien sûr, il est plus facile de commander une nouvelle péniche dans un chantier naval qui répond immédiatement aux exigences du client, mais le plus souvent on achète une vieille péniche à ces fins. En plus de la modernisation, il est nécessaire d'effectuer un entretien préventif pour éliminer la terre et la rouille tous les 2 ans et pour cela il faut soulever le navire jusqu'au rivage. Il y a un autre point ici : bien que la péniche soit transformée en immeuble résidentiel, elle ne peut pas se déplacer librement ni s'arrêter n'importe où. Des zones spéciales sont réservées au stationnement de ces péniches. [2]

La technologie de construction des maisons sur l'eau à l'aide de pontons est apparue il n'y a pas si longtemps. Elle est basée sur l'utilisation des pontons spéciaux qui sont combinés entre eux en une seule plate-forme flottante. Cette plate-forme maintient la maison sur l'eau. Selon le matériau, les pontons sont en béton armé, en plastique ou en métal. Les pontons en béton armé sont constitués d'une boîte de forme cubique dont les parois sont en béton armé et dont les vides sont remplis de matériaux isolants légers, comme la mousse de polystyrène. Malgré son poids assez important (certains bateaux flottants peuvent être très grands et conçus pour plusieurs dizaines de personnes), la conception présente une bonne stabilité et les caractéristiques d'un navire

qui flotte bien et ne coule pas. Les pontons en plastique sont utilisés pour y placer des structures légères et des structures sur celles-ci. Ils sont reliés par des encrages spéciaux. [3]

Résultats d'analyse. Si nous ne parlons pas des bâtiments modulaires, car la conception typique des maisons sur l'eau n'est pas encore répandue en Ukraine, elles seront relativement plus chères pour les futurs propriétaires en fonction des solutions de conception et d'architecture individuelles que par rapport aux maisons concurrentes sur un terrain ordinaire. Le coût au mètre carré d'une maison flottante dépend des conditions spécifiques du projet. Par exemple, une maison à un étage pour une ou deux personnes d'une superficie d'environ 50 mètres carrés, construite avec une structure en acier, empilé avec une tige, peut coûter 1 500 $/m^2. La construction d'un tel bâtiment peut prendre de 4 à 6 mois. Une maison à un étage en tôle pleine avec isolation peut être commandée pour environ 1 000 $/m^2 et le constructeur peut la bâtir en 2 ou 3 mois. Une maison familiale à deux étages d'une superficie de 160 mètres carrés qui est construite en 6 mois, coûte pour le client environ 200 000 $ ou 1 250 $ par mètre carré. Au premier étage de cette maison se trouvent : séjour, cuisine, dressing, sauna, salle de bain. Au deuxième étage se trouvent 3 chambres et 2 salles de bains. En règle générale, le coût de la maison comprend l'exécution de tous les documents avec l'inscription de la maison en tant que navire stable dans le registre des navires d'Ukraine avec la délivrance du livre du propriétaire au client. A titre de comparaison : vous pouvez construire une maison de 55 m^2 sur un terrain sans décoration intérieure et sans raccordement aux communications en 3 mois à un prix d'environ 15 000 $ ou 271 $/m^2 en 3-4 mois et environ 400 $/m^2 pour des frais de construction pour une maison en rondins de la même superficie, une maison en briques peut coûter 600 $/km^2.

Conclusions. Avantages des maisons flottantes : des avantages significatifs des maisons flottantes en termes d'adaptation au changement climatique, notamment de protection contre les inondations, ont été démontrés. Leur empreinte écologique peut être beaucoup plus faible car des sources d'énergie renouvelables et des systèmes de gestion durable des déchets peuvent être utilisés. Elles peuvent être économiquement

viables sous certaines conditions et apporter une contribution sociale à l'élargissement du fond immobilier et à la création d'espaces de vie uniques.

RÉFÉRENCES

1. Manuel de formation. (2021). Principales priorités pour la construction de bâtiments flottants ». Récupéré de : https://lib.lntu.edu.ua/sites/default/files/2021-02/stmrb_2017_7_46.pdf

2. Site Web. [Ressource électronique] Maisons sur l'eau : expérience globale et domestique. Mode d'accès : http://www.cre8tivez.org/nedvijimost/budinki-navodi-svitovij-i-vitchiznyanij-dosvid/

3. Site Web. [Ressource électronique]. Une maison sur l'eau - belle, fiable et pas chère ? Mode d'accès : https://dom.ukr.bio/ua/articles/1582/

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APPLICABILITY OF MINERALS IN THE CONSTRUCTION OF NUCLEAR POWER PLANTS

The construction of nuclear power plants is a very responsible process due to the complexity and danger of this structure, therefore the selection of materials must be diligent. The use of various minerals and rocks in the production of equipment and raw materials for the nuclear industry, including the manufacture of fuel assemblies (FA), is well known. The use of minerals directly in special structures is less well known, especially special types used in the construction of nuclear power plants and other nuclear industry facilities [1]. There is the list of such minerals with an indication of their use.

- **Quartz** is used in the composition of inert materials for concrete. It is used for all building structures and in the form of microsilica in the composition of self-compacting concrete.
- **Hematite**, **magnetite** are used as additives in concrete biological protection of reactors. It is used as a gamma-ray absorber and weighting agent.
- **Barite** is used as an additive in concrete for biological protection of RMBK reactors. It is used as microsilica in self-compacting concrete and is a component of plaster for the walls of X-ray laboratories and weighting agent [3].
- **Zeolites**, **halite** are used as additives in the composition of porous glass ceramics (foam glass). It is used for insulation of building structures.
- **Chromite** is used as an additive in concrete. It is used to increase radiation resistance.
- Limonite, clay minerals (kaolinite), chrysotile asbestos, serpentine (asbestos), colemanite (ulexite), datolite are used as additives in concrete for biological protection of reactors. They act as an absorber of thermal neutrons, and limonite, colemanite (ulexite), datolite are also an absorber of gamma rays.
- Feldspars (orthoclase) are used in the composition of inert materials for concrete. It can be used for all building structures.
- Carbonates (calcite) are used in the composition of inert materials for concrete and ballast crushed stone cushions. It is used for all building structures in the form of micro calcite in the composition of self-compacting concrete.
- Carbonates (dolomite) are used in the composition of inert materials for concrete and crushed stone cushions. It is used for all building structures.
- Clay minerals (bentonite) are used as a base for special concretes for the disposal of radioactive waste (RAW). It is used as a component of insulating safety barriers [2].

Making conclusions, it is necessary to mention that the above list of minerals can be used to build nuclear power plants. This data can be very useful for building nuclear power plants and simplify the construction process.

REFERENCES

1. Klyuchnikov, A. A., Pazukhin, E. M., Shigera, Yu. M., & Shigera, V. Yu. (2005). Radioaktivnye otkhody AES i metody obrashcheniya s nimi [Radioactive waste of NPPs and methods of handling them]. Institute for Safety Problems of Nuclear Power Plants of the National Academy of Sciences of Ukraine.

2. Kirov, V. S. (2018). Atomnye bezopasnosti blokov AES s VVER, dezaktivatsiya na AES, osnovy proektirovaniya blokov AES s VVER. Uchebnoe posobie dlya studentov spetsialnosti 6.050603, 143 – Atomnaya energetika dlya elektricheskie stantsii (chast' 2) [Nuclear safety of NPP units with VVER, decontamination at NPPs, basics of designing NPP units with VVER. Textbook for students of specialty 6.050603, 143 – Nuclear energy for power plants (Part 2)]. Odessa National Polytechnic University.

3. EGU. (2023). EGU23, the 25th EGU General Assembly, 23-28 April 2023, Vienna, Austria and online (ID: EGU-17181). https://doi.org/10.5194/egusphere-egu23-17181

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APPLICATION EXPERIENCE OF THE "TOP-DOWN" METHOD IN THE CONSTRUCTION OF MULTI-STOREY AND HIGH-RISE BUILDINGS

The global construction sector has witnessed significant expansion in multi-story and high-rise building projects, with skyscraper development showing remarkable growth over the past decade. According to data from the Council on Tall Buildings and Urban Habitat (CTBUH), the number of buildings exceeding 200 meters in height has surged from 602 in 2012 to more than 2000 by 2022, underscoring the increasing prominence and significance of high-rise construction within contemporary engineering practice.

The proliferation of tall buildings spans of various functional types, including residential, commercial, and mixed-use developments. Prominent examples illustrating this trend include Dubai's Burj Khalifa, currently the world's tallest building; Shanghai

Tower, noted for its distinctive spiral design; and The Shard in London, a landmark seamlessly integrated into a historic urban environment. These developments reflect the architectural and engineering innovations essential in modern construction practice.

High-rise construction predominantly occurs in densely populated urban centers, where land scarcity presents substantial challenges and necessitates development within constrained spatial conditions. Notable cases include the La Défense district in Paris, which harmonizes contemporary skyscrapers within historical urban contexts; The Shard in London, constructed within the city's limited central area; and Lotte World Tower in Seoul, strategically located in an intensely developed urban landscape. Such restrictive contexts demand careful consideration and selection of appropriate construction methodologies to ensure project success and minimize disruption.

This research aims to establish methodological principles guiding the application of the “top-down” construction method in multi-story and high-rise building projects. Additionally, the study seeks to develop an evaluative framework for assessing the effectiveness of this method, thus providing a robust basis for informed organizational and technological decision-making within construction management practices.

The research methodology involves an extensive review and critical analysis of existing literature, complemented by statistical data on the practical application of the “top-down” method in contemporary high-rise projects. Through this analysis, key methodological principles and influential factors affecting organizational and technological choices will be identified and categorized.

The “top-down” method represents an innovative construction technique that enables concurrent execution of underground and above-ground building components. This approach significantly accelerates project timelines and reduces environmental impacts, offering particular advantages in dense urban settings where site access and resident disruption are major concerns. Given that the construction of underground structures can constitute up to half of the overall project timeline, implementing the “top-down” method provides substantial reductions in both duration and associated costs compared to conventional construction methods. Furthermore, this method

mitigates potential adverse impacts on adjacent structures, enhancing its suitability for densely built urban environments.

Nevertheless, alongside its evident advantages, the “top-down” method introduces complexities related to site management and logistical planning. The simultaneous construction of subterranean and above-ground building sections demands rigorous organization and detailed technological planning, including enhanced safety protocols and meticulous coordination.

Effective decision-making regarding organizational and technological aspects requires comprehensive consideration of multiple variables, such as building geometry (especially subterranean dimensions), surrounding urban density, technical capacities, and available human resources. Hence, there is a clear necessity for further scientific inquiry into identifying and systematizing these factors, particularly during the project planning phase. Developing a structured methodology for assessing the effectiveness and efficiency of the “top-down” method is therefore essential to support optimal decision-making processes.

In conclusion, the “top-down” construction approach offers significant advantages for multi-story and high-rise developments in dense urban areas, optimizing project schedules, reducing costs, and lessening environmental impact. Its successful application requires careful consideration of various influencing factors, including structural dimensions, technological capabilities, and workforce availability. Nonetheless, expanding the practical adoption of this method necessitates clearly defined evaluative criteria, justifying additional research. Such efforts will contribute not only to economic efficiency but also to the sustainable advancement of construction practices and the enhanced competitiveness of construction enterprises globally.

REFERENCES:

1. DBN A.3.1-5:2016. Organization of construction production.
2. DBN V.2.2-41:2019. High-rise buildings. Basic principles
3. DBN V.1.2-12-2008. Construction in conditions of dense urban development. Safety requirements.

4. Council on Tall Buildings and Urban Habitat (CTBUH). “CTBUH Year in Review – Tall Trends of 2022”. [Online resource]. Available: https://global.ctbuh.org/resources/papers/4640-Journal2023_IssueI_YIR.pdf

5. The Shard at London Bridge. Structure Case Study by: Leslie Tijerina - Adrian Silvas - Hardik Jariwala Azadeh Mahmoudi - Saideh Sadri - Behzad Yaghmaei. (2016). ARCH-631 / Dr. Anne Nichols Fall. https://faculty.arch.tamu.edu/anichols/courses/applied-architectural-structures/projects-631/Files/ShardTower.pdf

6. Zayats, Ye.I., Kravchunovska, T.S, Tkach, T.V. (2021). Organization of construction of high-rise buildings: textbook. Dnipro : Zhurfond.

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MODERN TRENDS IN LANDSCAPING

According to data established by the World Health Organization (WHO), the standard for urban greening should be 50 square meters of urban green space per resident. Cities where vegetation covers less than 10% of the urban area are considered unfavorable in terms of greening, while those with 40–60% greenery are considered favorable for living. The standard for public green spaces in large cities is 21 square meters per person, or 2.1 hectares per 1,000 people. Unfortunately, only six large cities in Ukraine meet this standard, with at least 21 square meters of green space per resident. These cities are Ternopil, Nikopol, Bila Tserkva, Rivne, Lviv, and Ivano-Frankivsk.

Nowadays, there is a wide range of modern approaches to greening public spaces, high-rise residential buildings, and multifunctional public facilities. Let us take a closer look at some of these by creating our own catalogue of green plantings [1].

Sensory Garden

A sensory garden is a garden environment designed to stimulate the senses. This stimulation is achieved through using of plants and specific materials that engage all five

senses: sight, smell, touch, taste, and sound. A therapeutic corner usually occupies a small area and can serve as a substitute for a relaxation zone or a playground.

These types of gardens are popular among both children and adults, especially those with sensory processing issues, including autism and other impairments [2].

A sensory garden is also widely used to help restore a harmonious psychoemotional state in people with sensory impairments. For instance, if a person has poor eyesight, the other senses become more acute and compensate, helping them to perceive the world more fully.

However, for residents of large cities, especially for those who need rehabilitation after an illness or revival of mental strength, a visit to such a garden will not be superfluous.

Mini-Forests

Mini-forests - small areas are densely populated by a variety of plants. They can be located anywhere. For example, overcrowded and polluted urban areas that need the most help in maintaining clean air and water are suitable places for mini-forests.

Trees absorb carbon dioxide and polluted air, reduce water pollution and create noise insulation. They also provide habitat for other creatures such as birds and insects. Although mini-forests are small in size, they can restore biodiversity in cities as effectively as large natural forests.

The method of creating mini-forests is simple:

- Identify small urban land plots.
- Select a variety of tree species, preferably from local forests.
- Prepare the soil.
- Finally, plant a large number of young saplings.

Urban mini-forests also allow people to connect with nature without leaving the city, which is especially important in densely populated areas where the fast pace of life leaves little time to travel to real forests [3].

Vertical Landscape

Vertical landscaping is a direction of landscape improvement, which implements landscaping of territories not in the usual, horizontal way (on windowsills or tables), but vertically (on walls or special suspended structures) [4].

Greening buildings today is an effective way of improving the environmental situation in cities. Modern technologies and structures make it possible to create convenient, efficient and economical systems for landscaping structures. Using of modern vertical landscaping technologies makes it possible to create unique projects of facades that fill streets and buildings with living vegetation without attracting additional territories [5].

Many researches prove that the use of facade landscaping elements has a positive effect not only on the environment, but also on the indoor climate, creating an energy saving effect. For example, in the heat days, a green wall provides significant energy savings for any building. The surface covered with plants heats up less in the summer, which allows you to significantly save on air conditioning. In the cold season, the vertical garden system is an additional layer of insulation. The air gap between the wall and the vertical garden reduces heat loss and prevents cold air from entering the building.

Conclusion. The growing of Ukrainian cities, the increase in the number of cars, the construction of new plants significantly disimprove the state of the environment. That is why modern methods of landscaping for the improvement of city streets are becoming increasingly relevant. Urban gardening helps restore the natural balance and decorates the space. It is proved that greens, flowers, trees have the most favorable effect on a person, and the opportunity to look at leisure for green spaces improves his emotional state. The presence of public gardens and parks allows residents to walk and play sports outdoors. Flower plots near hospitals and health facilities cheer up patients.

Vertical gardening, “green” roofs, facades, terraces, turned into gardens and mini-forests can already be seen in different parts of the world.

REFERENCES

1. Бондар, А., Кучеренко, Л., & Редченко, В. (n.d.). *"ЗЕЛЕНА АРХІТЕКТУРА" СУЧАСНИХ МІСТ*. Retrieved May 13, 2025, from https://ir.lib.vntu.edu.ua/bitstream/handle/123456789/30416/%D0%9A%D1%83%D1%87%D0%B5%D1%80%D0%B5%D0%BD%D0%BA%D0%BE.pdf?sequence=1&isAllowed=y

2. *StackPath*. (n.d.). Www.gardeningknowhow.com. https://www.gardeningknowhow.com/special/accessible/sensory-garden-ideas.htm

3. Reynandez, R. (2019). *Innovative Ways to Create More Urban Green Spaces.* Project Learning Tree. https://www.plt.org/educator-tips/urban-green-spaces/

4. Як подолати «ефект міського теплового острова», або перспективи вертикального озеленення в Україні. (2020). https://propertytimes.com.ua/trends/yak_podolati_efekt_miskogo_teplovogo_ostrova_abo_perspektivi_vertikalnogo_ozelenennya_v_ukrayini

5. *МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ ДНІПРОВСЬКИЙ ДЕРЖАВНИЙ АГРАРНО-ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ*. (n.d.). Retrieved May 13, 2025, from https://dspace.dsau.dp.ua/bitstream/123456789/4270/1/%D0%A0%D0%B0%D1%82%D1%83%D1%88%D0%BD%D0%B8%D0%B9%20%D0%9C.%D0%9C.%20%281%29.pdf

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L'IMPACT DE L'INTELLIGENCE ARTIFICIELLE SUR L'ARCHITECTURE

Actualité. Chaque année, l'intelligence artificielle (IA) influence de plus en plus le domaine de l'architecture, transformant les processus de conception et de construction. Elle peut être utile à différentes étapes du projet, en contribuant à accroître l'efficacité, la durabilité et la créativité dans la pratique architecturale.

Positionnement du problème. L'intégration croissante de l'IA dans l'architecture soulève des questions sur la manière dont cette technologie peut optimiser les processus tout en respectant les enjeux liés à la créativité, à la sécurité et

à la réglementation. La rapidité d'analyse, la capacité à générer de multiples options et à automatiser des tâches complexes offrent de nombreux avantages, mais nécessitent également une réflexion sur les implications juridiques et éthiques.

Objet d'études. Dans un premier temps, lors de la «conception générative», l'IA analyse des données brutes et propose des solutions architecturales optimales. Par exemple, Zaha Hadid Architects a utilisé cette approche dans le projet du Centre Heydar Aliyev, et BiG a employé Autodesk Generative Design pour le projet de l'Opéra et du Théâtre du Kosovo.

Au stade de la conception et de la modélisation, l'IA aide les architectes à créer rapidement des modèles 3D complexes, en tenant compte des normes de sécurité, des conditions climatiques et de l'esthétique environnementale. Les programmes de conception générative basés sur l'IA peuvent générer des dizaines, voire des centaines d'options de conception, en fonction des paramètres et des exigences donnés. Par exemple, le bureau d'architecture «Archimatika» (Kyiv) recherche la solution d'image optimale à l'aide de Veras, un outil d'IA qui propose des solutions de façade basées sur un modèle de bâtiment réel. L'IA peut également analyser de grandes quantités de données sur les matériaux, interpréter l'environnement du bâtiment, réaliser des estimations de coûts et communiquer les résultats des calculs à l'architecte, ce qui réduit considérablement le temps de préparation du projet.

L'utilisation de l'IA augmente l'efficacité des processus en anticipant d'éventuels problèmes et en minimisant leur apparition. Elle automatise aussi de nombreuses tâches qui nécessitaient auparavant beaucoup de ressources humaines: effectuer des calculs, évaluer la qualité des matériaux, prédire les risques et estimer les coûts. De plus, l'IA analyse de gros volumes de données et trouve des solutions optimales beaucoup plus rapidement qu'un humain.

L'IA permet également de contrôler la consommation énergétique des bâtiments, en proposant des solutions pour la réduire et en contribuant à la création d'intérieurs plus durables. Les systèmes d'automatisation gèrent l'éclairage et la température, en s'adaptant aux habitudes des résidents.

Au stade de la visualisation et de la présentation, l'IA facilite la création de rendus photoréalistes de projets, ce qui simplifie la présentation des concepts aux clients et aux parties prenantes.

Conclusion. Le développement futur de l'IA dans l'architecture promet encore plus d'intégration et d'amélioration des processus. De nouveaux métiers devraient émerger à l'intersection de l'architecture et de la technologie, ainsi qu'une collaboration plus étroite entre l'IA et des technologies telles que l'impression 3D et la réalité virtuelle, pour créer des projets encore plus réalistes. Par ailleurs, la construction autonome, où des robots effectueraient la majorité des tâches, devient de plus en plus envisageable. La réglementation juridique des œuvres architecturales créées à l'aide de l'IA reste un enjeu important, car les questions de droits d'auteur et de responsabilité doivent être clairement définies.

RÉFÉRENCES

1. Tsatsenko Yev. Comment l'IA change l'architecture | SKVOT. https://skvot.io/uk/blog/yak-ai-zminyuye-arhitekturu
2. Naglaa, A. (2015). Megahed. Digital Realm: Parametric-enabled Paradigm in Architectural Design Process. *International Journal of Architecture, Engineering and Construction*. 4(3). 174-183.

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L'ARCHITECTURE DU FUTUR: À QUOI DOIT-ELLE RESSEMBLER?

«Dans un monde en perpétuelle transformation, le métier d'architecte émerge comme un pilier fondamental pour bâtir notre avenir». [2]

L'architecture, ce ne sont pas seulement des bâtiments. C'est un espace où nous vivons tous les jours. Le monde moderne change très vite. L'architecture doit aussi changer avec la société. Aujourd'hui, il y a beaucoup de problèmes : le changement climatique, la croissance des villes, le besoin de confort et de sécurité. Les architectes doivent trouver des solutions nouvelles. L'architecture du futur doit protéger la nature et répondre aux besoins des gens.

J'ai choisi trois idées importantes pour l'architecture du futur : le développement durable, l'urbanisme et l'architecture centrée sur l'homme.

Le développement durable est une idée très importante. «Le "durable", dans ses définitions diverses, est aujourd'hui devenu incontournable dans les discours urbains. Or ce changement de perspective n'est pas sans effet sur la manière de fabriquer la ville contemporaine» [3]. Il faut utiliser peu de ressources naturelles et produire peu de déchets. On peut utiliser des matériaux écologiques, des technologies qui économisent l'énergie, des toits verts, et récupérer l'eau. L'architecture doit aussi utiliser la lumière du soleil et le vent pour consommer moins d'électricité. Ces bâtiments sont bons pour la planète et aussi économiques pour les gens.

La deuxième idée est l'urbanisme, c'est-à-dire l'organisation de la ville. Aujourd'hui, les villes sont grandes et il y a beaucoup de voitures. Il y a peu d'espace. L'architecture ne doit pas créer seulement des bâtiments, mais aussi des villes confortables. Il faut organiser la ville pour que tout soit proche : l'école, le parc, l'hôpital, les magasins. C'est l'idée de la «ville des courtes distances». Les gens peuvent aller partout à pied.

La troisième idée est l'architecture centrée sur l'homme. L'architecture du futur pense d'abord à la personne. «L'architecture a pour qualité première de se mettre au service : l'utilisateur occupe une place centrale» [1]. Il faut créer des espaces calmes, logiques, avec de la lumière. C'est important pour le bien-être. Aujourd'hui, les gens travaillent à la maison, étudient à la maison. Donc, les espaces doivent être flexibles. Une cuisine peut devenir un bureau. Un balcon peut devenir une salle de sport. L'architecture doit s'adapter à ça. Il faut aussi penser à l'accessibilité: les personnes

âgées, les enfants, les personnes en fauteuil roulant doivent utiliser les espaces sans problème.

Le monde change, et l'architecture change aussi. Il y a beaucoup de défis: l'écologie, la vie en ville, les problèmes sociaux. Mais ces défis sont aussi des opportunités. L'architecture du futur n'est pas seulement belle. Elle est responsable, écologique, accessible et confortable. C'est une architecture pour la vie, pour les gens, et pour la planète.

RÉFÉRENCES

1. Hubert-Jan, Henket, Hubert-Jan, Henket, (2024). Wikipedia, Disponible sur: https://fr.wikipedia.org/wiki/Hubert-Jan_Henket
2. L'architecte Du Futur: Role Et Responsabilites. Disponible sur: https://lacritiquelibre.fr/autres-articles/larchitecte-du-futur-role-et-responsabilites/
3. Métropolitiques, Fabriquer la ville à l'heure de la durabilité, (2011). Disponible sur: https://metropolitiques.eu/Fabriquer-la-ville-a-l-heure-de-l.html

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CIRCULAR MODEL AND CARBON FOOTPRINT IN CONSTRUCTION INDUSTRY

One of the greatest potentials in terms of contribution to sustainable development is the construction sector. Achieving sustainable development criteria in this area is possible by ensuring innovative development with economical and rational use of natural resources, transition from non-renewable raw materials, materials and products of primary processing to products based on recycling technologies,

implementation of “green” design and technical solutions, energy saving measures, environmentally friendly energy and the use of energy-efficient solutions. These solutions will significantly reduce greenhouse gas emissions into the atmosphere, improve the quality and longevity of the population.

The current global trend in the development of various sectors of the economy is the transition to a circular model [3]. Until recently, most manufacturing enterprises worked with the principles of a linear economy, with constant extraction of resources from nature, production of products and their simple “throwing away” after the end of use. The circular economy aims to maximize the use of materials and resources available to society, applying three basic principles: reduction, reuse and recycling. Thus, the life cycle of products is extended, waste is given a new life and does not end up in landfills, and a more efficient and sustainable production model is implemented.

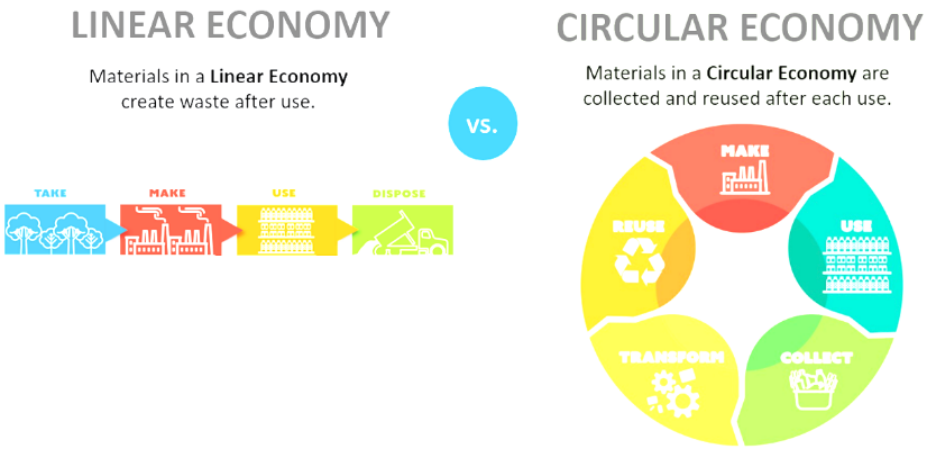

Fig. 1. Differences between the linear and circular models

The construction sector has high potential for implementing circular economy strategies [2]. Adopting circular economy principles in the construction industry will promote the use of environmentally friendly materials, maximize material recovery, and prevent unnecessary waste generation and disposal in landfills.

The amount of greenhouse gases in equivalent tons of CO_2 emitted during the production, use and disposal of products and services is called the carbon footprint. It is well known that the construction sector accounts for approximately 40% of energy consumption and 33% of CO_2 emissions from the total [1]. One way to significantly reduce the carbon footprint of buildings is to introduce, at the design stage, building

materials and products made from locally sourced, secondary raw materials suitable for recycling. The justification of innovative solutions and technologies for popularizing the concept should include the development of special measures that will demonstrate not only environmental benefits, but also economic feasibility.

The article [5] systematizes the data available in the literature on the quantification of embodied carbon from direct and indirect emissions, and also demonstrates the application of a hybrid method for assessing the life cycle of buildings.

The authors [4] provide a comprehensive overview of embodied energy and carbon data for 223 building insulation materials, based on environmental product declarations, with a focus on innovative and insulating materials. The comparative analysis was performed using the same functional unit (1 m^2 with a thermal resistance of 1 m^2K/W and a design life of 50 years) for each material, which the authors denoted as “FU”. Overall, the authors conclude that insulation materials are an effective solution for reducing operational energy consumption in buildings and improving their environmental profile.

In conclusion the above considerations highlight the significant potential of the construction sector to contribute to sustainable development by moving towards a circular economy. The introduction of innovative solutions, the use of environmentally friendly materials and the application of life cycle assessment are key to minimizing the carbon footprint of buildings and structures. Focusing on the economic feasibility of these changes will further facilitate their widespread adoption in the industry.

REFERENCES

1. Banu Sizirici, Fseha, Y., Cho, C.-S., Yildiz, I., & Byon, Y.-J. (2021). A Review of Carbon Footprint Reduction in Construction Industry, from Design to Operation. Sustainability, 14(20), 6094. https://www.mdpi.com/1996-1944/14/20/6094

2. Benachio, G. L. F., Freitas, M. D. C. D., & Tavares, S. F. (2020). Circular economy in the construction industry: A systematic literature review. Journal of Cleaner Production, 260, 121046.

3. Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on the circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production, 114, 11-32.

4. Pomponi, F., & Moncaster, A. (2016). Embodied carbon mitigation strategies for residential buildings: A review. Energy and Buildings, 133, 703-720.

5. Wan Mohd Sabki Wan Omar, Doh, J.-H., Panuwatwanich, K., & Miller, D. (2014). Assessment of the embodied carbon in precast concrete wall panels using a hybrid life cycle assessment approach in Malaysia. Retrieved from https://www.researchgate.net/publication/259170479_Assessment_of_the_embodied_carbon_in_precast_concrete_wall_panels_using_a_hybrid_life_cycle_assessment_approach_in_Malaysia

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L'IMPACT DE L'ENVIRONNEMENT ARCHITECTURAL SUR L'ÉTAT PSYCHO-ÉMOTIONNEL D'UNE PERSONNE DANS LA VIE QUOTIDIENNE

Actualité. L'environnement architectural joue un rôle essentiel dans la formation de l'état psycho-émotionnel d'une personne dans la vie quotidienne. Avec la croissance démographique et l'expansion des grandes villes, ces enjeux deviennent de plus en plus cruciaux. La planification spatiale, la palette de couleurs, l'éclairage, les textures et les formes influencent directement le niveau de confort, le contexte émotionnel et même les processus cognitifs. La psychologie architecturale montre qu'un environnement harmonieux peut réduire le stress, renforcer le sentiment de sécurité et favoriser l'équilibre intérieur [1]. À l'inverse, un environnement urbain chaotique et visuellement encombré peut provoquer anxiété et fatigue [2].

Objet d'études. Cet article examine comment la conception des espaces publics, des zones résidentielles et des lieux de travail influence l'état psycho-émotionnel des individus. Il met en lumière les principes de création d'un environnement confortable,

soutenant la santé psychologique, en s'appuyant sur les études modernes en psychologie architecturale et environnementale.

1. L'impact négatif d'un environnement architectural en mauvais état. Dans de grandes villes comme Kyiv, la capitale de l'Ukraine, on observe un chaos visuel marqué par des constructions non systématiques, une publicité abondante, des couleurs vives et un manque d'aménagement paysager harmonieux. Ce chaos visuel résulte d'une accumulation excessive d'éléments urbains sans cohérence esthétique. La diversité des façades, la prolifération de bannières publicitaires, la disparité des styles architecturaux et l'utilisation de couleurs déséquilibrées provoquent une surcharge sensorielle. La nécessité de traiter une grande quantité d'informations visuelles entraîne fatigue émotionnelle et augmentation de l'anxiété.

Outre les stimuli visuels, la pollution sonore joue un rôle majeur. Les niveaux de bruit dans les mégalopoles dépassent souvent les normes recommandées, nuisant à la santé physique et mentale des habitants. Le bruit constant du trafic, des travaux de construction et des rassemblements de foule génère un stress chronique, des troubles du sommeil, une augmentation de l'anxiété et une baisse de l'énergie vitale. Selon Shvedov, ces facteurs agissent comme des catalyseurs de stress et de fatigue psychologique chez les résidents.

2. Les effets positifs d'un environnement harmonieux. En revanche, des villes comme Berlin illustrent l'impact bénéfique d'une planification urbaine réfléchie. La présence d'espaces verts — parcs, jardins, boulevards et plantations naturelles intégrés à la ville — contribue à réduire le niveau de cortisol (hormone du stress), améliore la concentration et aide à restaurer les ressources émotionnelles.

Les promenades en nature, même en milieu urbain, permettent aux habitants de se sentir plus détendus et protégés. Les espaces publics bien conçus, avec un zonage clair pour piétons, cyclistes, bancs ou cafés, jouent également un rôle crucial. Ce zonage réduit les conflits, augmente le confort de séjour et crée un sentiment d'espace et de prévisibilité, essentiel pour la sécurité psychologique. L'utilisation de matériaux

naturels tels que le bois, la pierre ou les textiles dans la décoration des bâtiments et des lieux publics contribue à créer un environnement chaleureux et vivant.

À Berlin, on retrouve fréquemment des façades en bois, des pavés en pierre pour les trottoirs et une décoration naturelle du mobilier urbain. L'éclairage doux, utilisant des températures de couleur chaudes (de 2700K à 3500K) et des sources lumineuses dispersées (par exemple, à travers des plafonds givrés), ainsi qu'un placement judicieux des dispositifs d'éclairage, réduit l'effet d'éblouissement. Cet éclairage est souvent utilisé dans les parcs, rues piétonnes et places. Une palette de couleurs neutres et naturelles — beige, gris, olive, brun clair, bleu pâle ou vert — est privilégiée. L'utilisation de ces couleurs dans l'environnement urbain évite la surcharge sensorielle, créant une atmosphère calme et équilibrée. Selon les chercheurs modernes [3, 4], une conception globale respectueuse de l'environnement architectural contribue à améliorer la qualité de vie des habitants et à favoriser un état psycho-émotionnel positif.

Perspectives: comment appliquer ces connaissances dans la conception urbaine La pratique architecturale moderne intègre progressivement les principes de la psychologie environnementale dans la conception des villes. Sur la base des études sur l'impact de l'espace sur l'état psycho-émotionnel, plusieurs stratégies actuelles sont envisagées:

- Augmenter le nombre d'espaces verts en milieu urbain;
- Créer des zones de repos et d'interaction sociale paisibles;
- Zoner de manière efficace les zones bruyantes et actives;
- Utiliser des matériaux et des couleurs naturels dans la construction;
- Limiter la surcharge d'informations visuelles.

Prendre en compte ces principes permet de concevoir un environnement architectural qui aide à maintenir l'équilibre émotionnel, réduire le stress et améliorer la qualité de vie des résidents.

Conclusion. Ainsi, l'étude de l'impact de l'environnement architectural sur l'état psycho-émotionnel constitue une composante essentielle de la planification

urbaine moderne. La création d'espaces centrés sur le confort émotionnel et la santé mentale des citoyens devient une condition clé pour le développement durable des villes. La mise en œuvre des principes de la psychologie architecturale et environnementale permet de concevoir un environnement qui répond non seulement aux exigences fonctionnelles, mais qui contribue également activement au bien-être de chaque individu.

RÉFÉRENCES

1. Margarete. (2023). La psychologie architecturale. Medium. https://medium.com/archilyse/1-the-influence-of-architecture-on-our-psyche-f183a6732708
2. Шведов, К. (2016). Причини візуального хаосу в Києві https://hmarochos.kiev.ua/2016/10/26/balkoni-viviski-navigatsiya-dizayner-poyasnyuye-prichini-vizualnogo-haosu-v-kiyevi/
3. JC Architect (2024). L'Influence de l'Architecture sur l'Humeur et le Bien-être https://jcarchitect.com/fr/linfluence-de-larchitecture-sur-lhumeur-et-le-bien-etre/
4. Overturn.fr (2024). Plongez dans la Sérénité: Les Espaces Verts et le Bien-être en Ville https://www.overturn.fr/importance-des-espaces-verts-dans-le-bien-etre-en-ville/

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ENVIRONMENTAL IMPACT OF RENEWABLE ENERGY SOURCES

The level of material, and therefore spiritual culture of mankind directly depends on the amount of energy it has. To make any thing, energy is needed. The material needs of mankind, like the human population, are constantly growing, so the need for energy is increasing exponentially.

The media often inform us about new, more environmentally friendly methods of generating energy. However, the share of such sources in total energy production grows slowly. The reason is that no energy source has yet proven more cost-effective

than the traditional method of combustion. Today, a large percentage of energy is still obtained by burning coal, oil, natural gas, peat, and other fossil fuels. Yet, the energy reserves nature accumulated over hundreds of millions of years may last only a few hundred years.

Many scientists are searching for profitable renewable energy sources that could at least partially replace fossil fuels. Promising options include using energy from water and wind flows, ocean tides, geothermal heat, and solar energy[1]. There are also ongoing studies to replicate thermonuclear processes seen in stars[2]. Solar energy has great potential, but its use is limited by cost, resource intensity, and the need for vast areas(Fig. 1). For instance, to meet global energy needs by 2100 using solar energy, collectors would need to cover 1–3 million km². Moreover, solar energy systems require much more labor than traditional energy—50 to 80 times more. Therefore, large-scale use remains unrealistic, though solar plants can be useful in remote and sunny areas.

Wind energy also has enormous potential—air currents carry hundreds of times more energy than all rivers combined. Winds are present everywhere, from breezes to hurricanes, and could meet humanity's energy needs. However, most wind energy projects pay off slowly. Rising fuel prices may eventually make wind power more attractive and increase its share.

Hydropower has served people for millennia. With the advent of electricity, water wheels evolved into turbines. Hydropower plants offer renewable energy, ease of use, and minimal pollution. Yet, building dams requires flooding areas, which can cause irreversible environmental damage. Even well-planned dams affect landscapes, slow water flow, and may lead to waterlogging and algae blooms.

The Earth's interior holds powerful energy, evident in volcanoes. Though we haven't harnessed volcanic energy, Iceland successfully uses geothermal sources like geysers for heating. However, these resources are highly localized, limiting their global use.

The oceans also hold vast energy potential. Rising fuel prices have renewed interest in ocean energy. Tides are the most explored source, but other methods include cultivating kelp for methane production. Hydrogen extracted from the ocean is another clean fuel with

high energy content, though storage remains a challenge due to its explosiveness. Overall, the ocean acts like a giant battery, absorbing solar, wind, and gravitational energy.

Despite advantages, renewable energy sources can negatively impact the environment. They often require significant land, altering landscapes, increasing noise (windmills), and causing soil or water pollution (geothermal and biomass plants). Additionally, many have low capacity and limited applicability.

Wind farms do not pollute the air with chemicals, but they do create noise. So, although placing a large number of generators close together makes for more efficient operation, many people find it unacceptable. These power plants work most efficiently in strong winds, but they are vulnerable to hurricanes.

Solar energy, the most powerful source, is hindered by land use and sunlight variability. Biomass energy, while carbon-neutral in theory, releases carbon monoxide and soot when burned and suffers from low turbine efficiency. Converting biomass to methane for gas turbines is more efficient, especially where agricultural waste is plentiful. Methanol and ethanol from biomass can also fuel vehicles.

In recent years, growing concern over environmental issues like acid rain and climate change has pushed interest in renewable energy. While these sources are cleaner, it’s important to acknowledge that no energy method is entirely without environmental impact.

Conclusions. As we can see, the strategy for introducing alternative energy is a very complex topic. There are significant obstacles to the introduction and operation of alternative fuels. New technologies for extracting energy resources are being introduced in our country, but not quickly.

Given the volume of production at industrial enterprises, significant powerful introductions into power plants are necessary. The climate in Ukraine is not very suitable for the effective operation of enterprises using alternative energy sources. Therefore, we can conclude that the introduction of alternative energy can only partially satisfy the functioning of the enterprise.

REFERENCES

1. Golakova, I.V., Petrenko, V.O., Petrenko A.O. (2024). Energy efficiency of systems of life support of buildings in "green construction". *Environmental Safety and Environmental Management*, 1 (49), 60-67.

2. Energy efficiency and renewable energy sources (2007). K.: Ukrainian Encyclopedic Knowledge.

3. Non-traditional and renewable energy sources: educational manual. (2013). Kremenchuk: Shcherbatik O.V.

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ENERGY EFFICIENT TECHNOLOGY FOR PROVIDING THE ENVIRONMENTAL AIR PARAMETERS OF WORKING AREAS OF INDUSTRIAL BUILDINGS

The questions of providing of necessary microclimate of industrial apartments by the use of the systems of ventilation with the repeated use and filtration of air of working areas are considered in the article.

The process of human life indoors requires year-round provision and maintenance of the necessary parameters of the indoor air (temperature, humidity, mobility, cleanliness, physical and chemical composition).

One type of technology for ensuring the microclimate in production premises is the recirculation and filtration systems for air purification in working areas.

One of the types of technology for ensuring microclimate in production premises is recirculation-filtration air purification systems in working areas.

The transition of industry to new technological processes leads to the emergence of workplaces where people are not present during the entire technological period.

Therefore, it is impractical to provide the necessary microclimatic parameters during the absence of people. In this case, to ensure the microclimate, it is proposed to divide the workshop area into zones where the temperature regime is the same. To allocate a zone with a standardized microclimate, the concept of formation in plan and height has been added to the traditional ventilation scheme (inflow - exhaust).

Traditional methods of supplying air for general exchange ventilation do not always provide an economical mode of operation of heating and ventilation systems in production premises, and in addition, they have a number of disadvantages: significant air exchange, low efficiency coefficient and high energy consumption.

In order to reduce the negative impact on the environment and reduce energy consumption for ventilation technology, it is proposed to reduce the air exchange of general exchange ventilation to the minimum necessary reduction, and to remove harmful substances directly at the points of release using devices that do not allow them to spread throughout the volume of the room.

Moreover, special cycles have been introduced into the technology of ventilation of working areas, which increase its ecological purity:

First cycle. Air contaminated with harmful substances (HS) is taken in through highly efficient local exhaust devices, used in several HS variants sequentially through a series of filtering units with a high degree of purification and returned to the working area.

Second cycle. Air from the working area contaminated with HS residues that could not be removed by local ventilation (5-10% of the total amount of HS) is passed through filter and ventilation units installed near the HS emission points.

Third cycle. The exhaust air from general ventilation is cooled in recuperators and discharged outside the workshop, and the supply air, passing through all stages of purification, is heated in the recuperator and supplied to the working area through air distributors with controlled supply jet characteristics.

These cycles allow to reduce the use of heat to ensure the microclimate in industrial workshops by 20 - 35% depending on the degree of recirculation and recovery and reduce environmental pollution.

Installation of filter and ventilation units allows to reduce the air consumption of general ventilation to the minimum indicators that meet the requirements of sanitary standards. The type of these units is determined by the type of harmful substances that are released in the working area, their amount, the concentration of hazardous substances in the working area, and the installation location - by the physical process of the distribution of hazardous substances over the area and in the volume of the working area.

When using these units, the degree of air purification reaches (95 □ 3%), which allows the purified air to be returned to the premises. Such units can be manufactured in both stationary and mobile versions.

The use of the proposed technologies for ensuring the parameters of the air environment of the working areas of industrial workshops will allow to ensure maximum permissible concentrations (MPC), optimal and permissible combinations of temperature, air velocity in large-area workshops, while reducing heat and energy costs and increasing the efficiency of ventilation systems.

REFERENCES

1. Golakova, I.V., Petrenko, V.O., Petrenko A.O. (2024). Energy efficiency of systems of life support of buildings in “green construction”. *Environmental Safety and Environmental Management*, 1 (49), 60-67.

2. Energy efficiency and renewable energy sources (2007). K.: Ukrainian Encyclopedic Knowledge.

3. Non-traditional and renewable energy sources: educational manual. (2013). Kremenchuk: Shcherbatik O.V.

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ENERGY-EFFICIENT FACADES: INNOVATIONS IN DESIGN AND THERMAL INSULATION OF BUILDINGS

The objective of this study is to explore and critically evaluate the development and application of energy-efficient facade systems in modern architecture. The objective of this study is to identify the key technological innovations and materials employed in facade design that contribute to enhanced thermal insulation and reduced energy consumption in buildings. It is crucial to examine real-world case studies and to discuss the benefits, limitations, and future prospects of energy-efficient facades as a vital component of sustainable and low-carbon construction.

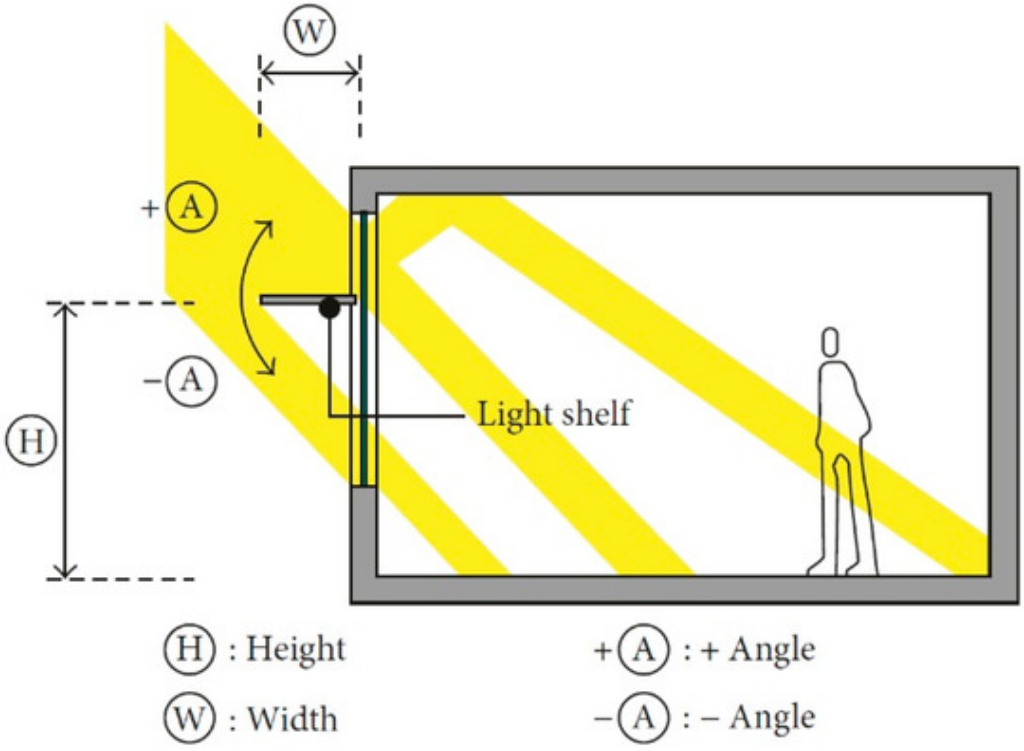
A sustainable or energy-efficient facade is a technologically advanced building exterior designed to optimise thermal performance, reduce energy demand and contribute to environmental sustainability. Conventional facades focus on aesthetics or protection; energy-efficient facades are a key part of a building's energy management strategy.

These facades regulate heat exchange between the interior and exterior environments, enhance natural lighting and ventilation, and often incorporate adaptive systems or renewable energy technologies (such as building-integrated photovoltaics, smart glazing, or kinetic shading devices). The design may incorporate high-performance insulation, double-glazed windows, ventilated cavity systems, and automated climate-responsive controls that serve to reduce reliance on mechanical heating and cooling systems. [1]

Benefits of High-Performance (HP) Facades

Heat goods. Advanced systems use high-quality insulating materials (like mineral wool, aerogels, or vacuum insulated panels) to minimize heat loss in winter and heat gain in summer, ensuring consistent indoor temperatures. This reduces the need for artificial heating and cooling which results in better thermal control leads to significantly lower energy demand for Heating, Ventilation, and Air Conditioning (HVAC) systems, cutting energy costs and reducing the building's carbon footprint. [2]

High-performance facades are not only thermal barriers but also climate-responsive systems that strategically manage daylight and airflow. In the context of building design, the utilisation of high-performance glazing (HP glazing) is a strategy employed to facilitate the transmission of visible light while concurrently minimising solar heat gain. This approach involves the incorporation of light shelves (see Picture 1), reflective coatings, or prismatic glazing into the architectural design. [3]



Picture 1 "Light shelf` s work"

The following elements are considered to be of particular significance in the context of natural ventilation: operable windows and ventilation flaps; double-skin facades that create an air cavity and automated louver systems.

Optimal lighting and fresh air have been shown to improve environmental sustainability, productivity and mental well-being.

An exemplar of a structure incorporating the aforementioned technologies is ***The Edge*** (Amsterdam, Netherlands). The 15-storey office building, constructed in 2014, has achieved renown for its sustainability and integration of smart building technologies. (See Picture 2) [4]

Picture 2 "The Edge"

The Edge's Aquifer Thermal Energy Storage system stores thermal energy in aquifers. It uses 2 deep wells (drilled 129 metres into the aquifer) to circulate water for storage. This significant system can store warm water in summer and cold water in winter, generating energy savings. The system utilises radiant panels to ensure the efficient maintenance of comfortable indoor temperatures.

The architectural design of the building is such that it maximises natural light by means of a substantial north-facing atrium and by making extensive use of glass in the facade. This configuration facilitates substantial daylight penetration whilst

minimising direct solar gain, thereby reducing the requirement for artificial lighting and enhancing occupant comfort. The south, east and west facades have been equipped with solar panels and shading devices. The purpose of this is to manage solar radiation while permitting daylight penetration.

The Edge shows how design and technology can create a sustainable, energy-efficient, comfortable working environment. Its systems have a considerable effect on the environment, with a marked reduction in impact being a key highlight. In terms of performance indicators The Edge consumes approximately 70% less electricity than comparable office buildings.

Additionally, the integration of solar panels on the building's facades and roofs ensures the generation of sufficient electricity to meet the building's energy demands, thereby contributing to its net-zero energy status.

Consequently, the objective of the study was successfully disclosed, thereby providing a clear understanding of how energy-efficient facades contribute to sustainable building practices and setting a foundation for future exploration and implementation in design frameworks. The argument shows how high-performance facades can reduce a building's energy consumption, enhance indoor comfort and reduce its environmental impact. A study of innovative facade technologies and The Edge in Amsterdam shows that contemporary facades are integrated environmental control systems, challenging the perception of them as simple building envelopes.

REFERENCES

1. Double skin facades. (n.d.). Cool Ideas in Photos. https://en.idei.club/49223-double-skin-facades.html
2. Glazing | YourHome. https://www.yourhome.gov.au/passive-design/glazing
3. Sabbagh, M., Mandourah, S. and Hareri, R. (2022). Light shelves optimization for daylight improvement in typical public classrooms in Saudi Arabia. https://doi.org/10.3390/su142013297
4. The Edge / PLP architecture. (2024). ArchDaily. https://www.archdaily.com/785967/the-edge-plp-architecture

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VIDEO-BASED STRUCTURAL DISPLACEMENT MONITORING IN CIVIL ENGINEERING: FROM CAPTURE TO ANALYSIS

1. Introduction

Structural health monitoring is essential for ensuring safety and resilience of buildings, bridges, and industrial constructions. Video-based displacement analysis provides an affordable and scalable alternative, yet it introduces a unique set of technical challenges. This study aims to outline a practical framework for using video footage to detect micro-movements in structural elements.

2. Video Capture: Techniques and Challenges

The accuracy of motion analysis heavily depends on the quality of video capture. Factors such as unstable lighting, low frame rate, sensor limitations[1], noise, lens distortion, and focal length affect the reliability of captured data. Proper tripod stabilization, and optimal camera settings (shutter speed, aperture, ISO) are essential for reducing noise and motion blur. Choosing a fixed focal length lens (e.g., 50-85mm) helps in minimizing distortions and maintaining consistent scale.

3. Motion Tracking in Software

Adobe After Effects provides built-in motion tracking tools which allow tracking of selected points or contrast markers on a structure. However, these tools struggle in low-contrast areas, during camera shake, or under varying light. Drift, marker loss, or noise-based tracking deviation are common.

4. Complementary Analysis Tool

TouchDesigner enables implementation of Optical Flow in real-time. This technique allows estimation of per-pixel motion between consecutive frames. It is

especially useful for measuring movement in non-rigid elements, vibration, and deformations too subtle for standard tracking. The software visualizes displacement vectors which can be calibrated into physical units (e.g., mm) based on known geometry.

5. Structural Use Cases and Calculations

Depending on the structure type (bridges, beams, facade panels, supports), video-based motion analysis can extract different types of information: horizontal or vertical displacement amplitude, frequency of oscillation under dynamic load, relative phase delay between parts of a structure.

6. Real-World Testing Example

Footage of **Kyiv Metro Bridge** bridge was captured and analyzed in After Effects using motion tracking. The test revealed measurable periodic deformation under dynamic loading, supporting the method's validity.

7. Conclusion and Future Work

Video-based structural health monitoring aligns with the goals of modern construction management: resource efficiency, minimal intrusion, and proactive maintenance planning. Future work will focus on developing methods to accurately calculate deformations and displacements of structures with reliable measurement scale. The goal is to achieve displacement detection accuracy and to overcome the limitations of low amplitude displacement response in videos by applying temporal processing within selected frequency bands in order to magnify sub-pixel motion changes[2], making video-based monitoring a practical tool for construction and civil engineering applications.

Argumentation

Video-based deformation tracking offers numerous advantages, such as cost-effectiveness, flexibility in deployment, and ease of data visualization. However, the precision of such systems is sensitive to various factors, making it difficult to track points. Motion tracking works effectively with markers or sharp edges, but subtle displacements often require the application of optical flow to enhance pixel-level

motion. These challenges necessitate combining multiple analytical approaches to ensure more reliable results.

Demonstration

Real-world example of the proposed method was carried out on the Kyiv Metro Bridge. Video footage was captured during peak traffic to observe dynamic structural behavior. The recorded footage was processed with motion tracking techniques. This test demonstrated measurable, periodic displacements of the bridge structure under live loading conditions, confirming the practical applicability of the non-contact video analysis method.

Results

The study confirms the viability of low-cost video analysis for structural health monitoring. While not a full replacement for high-precision sensors, such systems provide valuable supplementary data and visualization, especially during field testing or in resource-constrained environments. The results support further exploration into cost-effective and fast onsite tracking for structural diagnostics.

REFERENCES

1. Zhuang, Y.; Chen,W.; Jin, T.; Chen, B.; Zhang, H.; Zhang,W. A Review of Computer Vision-Based Structural Deformation Monitoring in Field Environments. Sensors 2022, 22, 3789. https://doi.org/10.3390/s22103789

2. Zimmermann, M., Gülan, U., Harmanci, Y., Chatzi, E., & Holzner, M. (2016). Structural Health Monitoring through Video Recording. 8th European Workshop on Structural Health Monitoring (EWSHM 2016), July 5-8, 2016 in Bilbao, Spain. e-Journal of Nondestructive Testing Vol. 21(8). https://www.ndt.net/?id=20118

Аграрні науки та продовольство: екологічність та продовольча безпека

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BIOPRODUKTE IM FOKUS: MODEERSCHEINUNG ODER BEITRAG ZUR NACHHALTIGKEIT?

Die naturnahe Produktionsweise des biologischen Landbaus und die schonende Verarbeitung der Biolebensmittel legen nahe, dass sich Bioprodukte qualitativ von konventionell hergestellten Lebensmitteln unterscheiden. Entsprechend hoch und weitreichend sind die Erwartungen der Konsument*innen an biologische Lebensmittel.

Bio-Lebensmittel sind Produkte, die so hergestellt werden, dass

- Pestizide zur Bekämpfung von Unkraut, Schädlingen und Pflanzenkrankheiten sowie mineralische Düngemittel synthetischen Ursprungs in der pflanzlichen Erzeugung verboten sind, während der Pflanzenschutz hauptsächlich mit Präparaten natürlichen Ursprungs erfolgt und organische Düngemittel für die Ernährung des Bodens und der Pflanzen verwendet werden;

- die Verwendung von gentechnisch veränderten Organismen ist streng verboten;

- Wachstumsförderer, Hormone und Antibiotika sind in der Tierhaltung nicht erlaubt, und zur Behandlung der Tiere werden prophylaktische und homöopathische Arzneimittel eingesetzt.

Nur Produkte, die nach anerkannten Regeln (Standards) erzeugt und nach dem festgelegten Verfahren zertifiziert wurden, können als ökologisch bezeichnet werden. Bioprodukte müssen ordnungsgemäß etikettiert sein. Das Etikett muss das entsprechende Logo sowie Informationen über die zuständige Zertifizierungsstelle enthalten.

Vorteile von Bio-Lebensmittel:

- Der ausgezeichnete Geschmack, die Abwesenheit von schädlichen Verunreinigungen und die hohen Qualitätsstandards von Bioprodukten wirken sich positiv auf Ihren Körper aus und schützen Ihre Gesundheit.

- Bio-Lebensmittel sind sicher für Mensch und Umwelt, sie sind nicht mit Nitraten, Schwermetallen, Pestizidrückständen, Herbiziden und anderen Chemikalien belastet.

- Bio-Lebensmittel enthalten keine Krankheitserreger, Parasiten oder allergene Bestandteile.

- Bioprodukte behalten ihre ernährungsphysiologischen Eigenschaften, ihre Qualität und ihre natürliche Zusammensetzung während der Verarbeitung, da nur natürliche Verarbeitungsmethoden und traditionelle Rezepte, natürliche Stoffe und Materialien für die Verpackung verwendet werden und die Verwendung synthetischer Aromen, Konservierungsmittel, Zusatzstoffe usw. verboten ist.

- Der Konsum von Bioprodukten trägt indirekt zur Erhaltung der Umwelt bei, da er sich positiv auf die Wiederherstellung der natürlichen Bodenfruchtbarkeit auswirkt, die natürliche Artenvielfalt erhöht und die Tiergesundheit verbessert, da Methoden der Tierhaltung angewandt werden, die den natürlichen Bedürfnissen der Tiere entsprechen und ihnen kein Leid zufügen.

Die ökologische Erzeugung in der Ukraine unterliegt der Zertifizierungspflicht. Sie erfolgt durch jährliche Inspektionen der zuständigen Zertifizierungsstellen.

Besteht ein Bioprodukt aus mehreren Zutaten, wie z.B. ein Brot oder ein Dessert, so müssen 95 % der Bestandteile biologisch sein. Die restlichen 5 % sind Bestandteile, die nach der Liste der Verarbeitungssubstanzen und Zusatzstoffe des Standards der internationalen akkreditierten Zertifizierungsstellen für ökologische Erzeugung und Verarbeitung, der den Verordnungen (EG) Nr. 834/2007 und Nr. 889/2008 des Rates entspricht, zulässig sind.

Zielgruppen. Laut „Daily Mail" hat eine Umfrage der Soil Association Certification ergeben, dass sich fast die Hälfte der Briten zwischen 25 und 34 Jahren wohler fühlt, wenn sie Bio-Lebensmittel kaufen. Sie glauben, damit einen positiven

Einfluss auf die Umwelt zu haben. Außerdem fühlt sich fast ein Viertel der Briten gesünder und glücklicher, wenn sie sich für nachhaltige Optionen entscheiden.

Eine YouGov-Umfrage, die ebenfalls von der „Daily Mail" zitiert wird, bestätigt: 41 Prozent der Erwachsenen lassen sich beim Einkaufen von ökologischer Nachhaltigkeit leiten. Besonders ausgeprägt ist der Trend bei den 18- bis 34-Jährigen. Mehr als 20 Prozent der 25- bis 34-Jährigen halten Gesundheitsvorteile, Nachhaltigkeit und reduzierte Verpackung für entscheidend. Kleine Haushalte mit ein bis zwei Personen bevorzugen Bio ebenfalls stärker als große Familien, bei denen der Preis aufgrund der gekauften Mengen an Lebensmitteln häufig eine größere Rolle spielt - insbesondere bei teureren Produktgruppen wie Fleisch.

Bioprodukte werden zunehmend als Bestandteil eines gesunden Lebensstils angesehen, da das Bewusstsein der Bevölkerung über die Auswirkungen der Ernährung auf die Gesundheit wächst. Die Wissenschaft ist jedoch noch nicht zu einer eindeutigen Aussage über die ernährungsphysiologischen Vorteile von Bioprodukten gegenüber konventionellen Produkten gelangt. Die Entscheidung für Bioprodukte ist also sowohl ein Element bewusster Gesundheitsvorsorge als auch der Einfluss moderner Kultur- und Modetrends.

LITERATUR

1. Nachhaltigkeit und Qualität biologischer Lebensmittel.(2021). Dossier. 1405. https://www.fibl.org/fileadmin/documents/shop/1405-lebensmittelqualitaet.pdf

2. Reichel, S. (2024, September 12). Millennials und Gen Z treiben Bio-Trend voran: Studie zeigt klare Präferenz. *FOCUS Online*. https://www.focus.de/gesundheit/millennials-und-gen-z-treiben-bio-trend-voran-studie-zeigt-klare-praeferenz_eab4c62f-d812-49e1-960b-8ced9252925a.html

3. Беба, Ю. (2020, July 3). *«Чому так дорого?»: що таке органічні продукти й чи дійсно вони кращі за звичайні*. The Village Україна. https://www.village.com.ua/village/food/food-guide/299237-organichni-produkti-scho-tse-oznachae

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TOMATO SAUCE PRODUCTION IN UKRAINE: CHALLENGES OF WAR AND DEVELOPMENT PROSPECTS

The tomato sauces production in Ukraine has always been an important segment of the agro-processing industry. Until 2022 Ukraine was among the top 10 global producers of tomato paste, and leading companies such as Chumak and Inagro held stable positions in the domestic and foreign markets. However, after the outbreak of a full-scale war, the industry suffered significant losses due to the destruction of production facilities, the occupation of part of the territory, and logistical difficulties. Nevertheless, Ukrainian producers are adapting to the new real situation by implementing anti-crisis measures and expanding export opportunities.

Before the war, Ukraine annually processed about 850-900 thousand tons of tomatoes, of which more than 60% were used to produce tomato paste and sauces. The main tomato growing regions were the south of the country - Kherson, Odesa and Mykolaiv regions, which had favourable climatic conditions.

The export component was also significant: in 2021, about 70% of products were shipped abroad, with the main consumers being the EU, the Middle East, and Africa.

Since the beginning of the full-scale invasion in February 2022, Ukraine's production capacity has decreased by at least 40% [Лебідь, 2023]. Companies in the southern region have suffered the most, including Chumak, whose main plant was located in Kakhovka, a city under occupation [Весніна, 2023].

Due to the fighting and landmines, tomato acreage decreased by 35%, leading to a shortage of raw materials. Accordingly, in 2022, the production of sauces fell by 60%,

and imported products began to displace Ukrainian brands from the domestic market [Лебідь, 2023].

Despite the difficulties, Ukrainian producers did not stop production. Here are some key strategies that have allowed the industry to gradually recover:

Relocation of enterprises - Chumak moved part of its production to the western regions of Ukraine, and some companies established cooperation with agricultural firms in the central part of the country [Весніна, 2023].

Expansion of processing capacities in safe regions - new plants are opened in Vinnytsia and Khmelnytsky regions. Changes in export routes - companies that used to use Black Sea ports are now shipping products through the western borders to the EU. Investments in technology - there is a gradual transition to energy-efficient equipment and more flexible production systems [EastFruit, 2023].

Dynamics of tomato sauces production (2021-2024) are shown in Fig. 1.

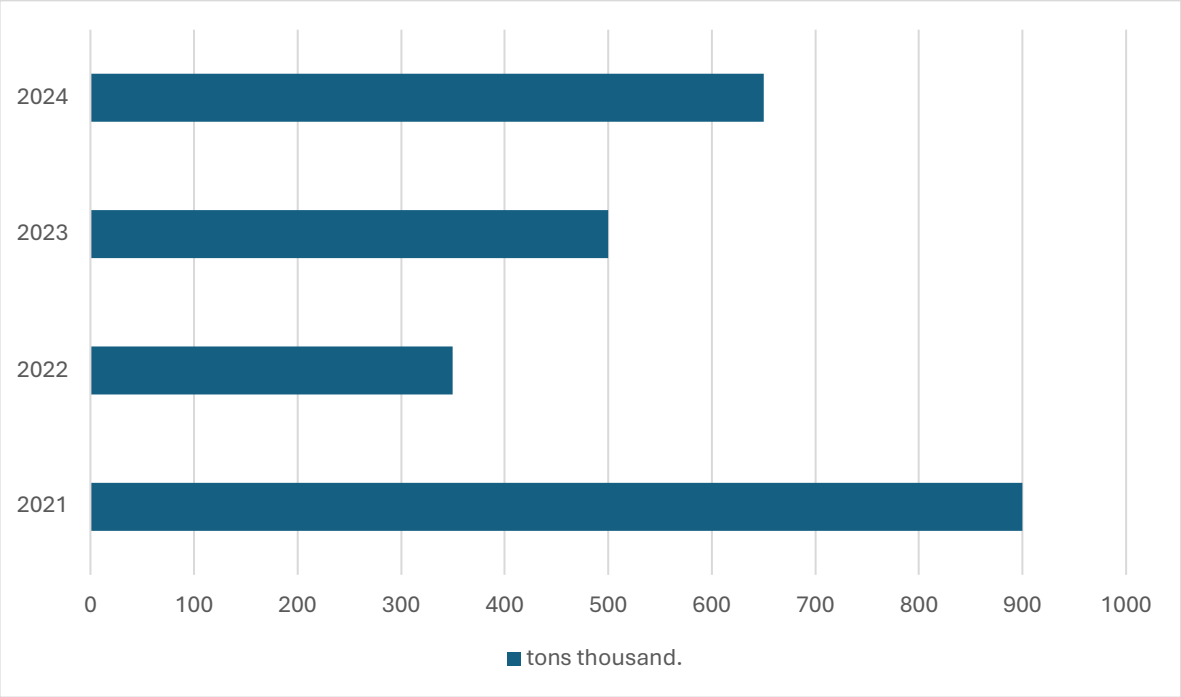

Figure 1. Reduction of production capacity due to the war

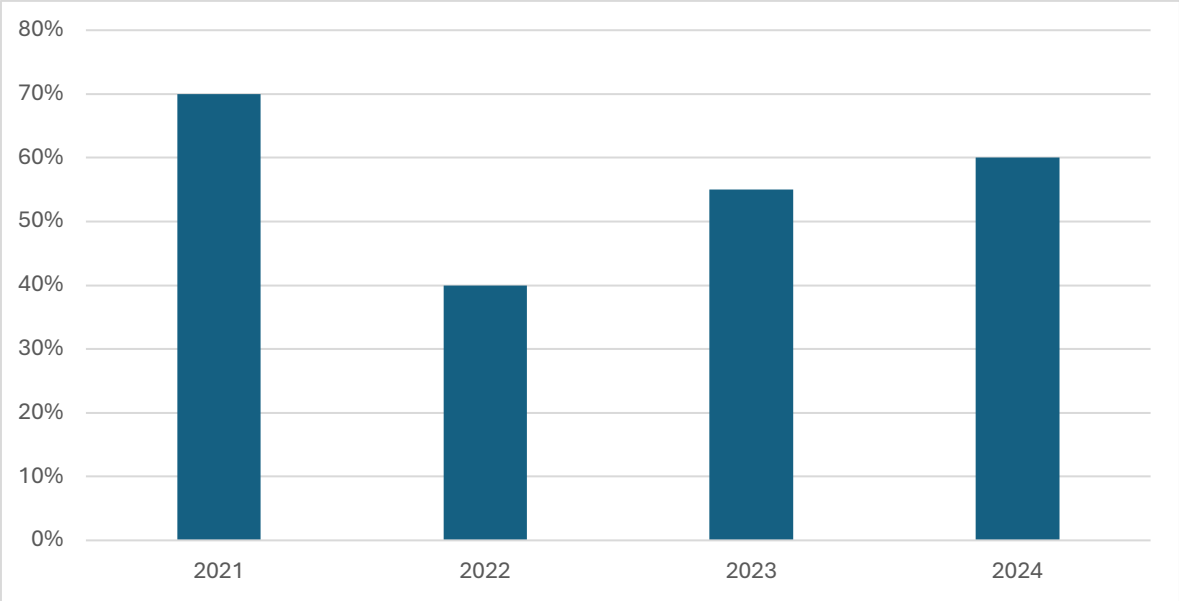

Figure 2. Share of exports in total production of tomato sauces (in % of total production)

Despite the devastating effects of the war, the Ukrainian food industry, including tomato sauce producers, has demonstrated resilience and flexibility. Thanks to relocation, technological innovations, and changes in logistics, the industry is gradually recovering, although it is not expected to reach pre-war production volumes until 2026 [EastFruit, 2023].

REFERENCES

1. Весніна Олена (2023). Одне з найбільших підприємств в Україні ПАТ "Чумак" планує релокацію переробних потужностей з Херсонщини на Одещину. *Портал новин Бессарабії*. https://bessarabiainform.com/2023/07/odne-z-naybilshih-pidpriemstv-v-ukraini-pat-chumak-planue-relokatsiyu-pererobnih-potuzhnoste

2. Лебідь Людмила (2023). Втрати від війни найбільшого виробника томатної пасти складають понад 8 млрд грн. *AgroPortal.ua* https://agroportal.ua/news/novosti-kompanii/vtrati-vid-viyni-naybilshogo-virobnika-tomatnoji-pasti-skladayut-ponad-8-mlrd-grn?utm_source=chatgpt.com

3. EastFruit. (2023). Український виробник томатної пасти планує до 2026 року переробляти 1 млн тонн томатів. *EastFruit*. https://east-fruit.com/uk/novyny/ukrayinskyy-vyrobnyk-tomatnoyi-pasty-planuye-do-2026-roku-pereroblyaty-1-mln-tonntomativ/?utm_source=chatgpt.com

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URBAN FARMING AND VERTICAL FARMS: PROSPECTS FOR AGRICULTURAL PRODUCTION IN CITIES

Urban agriculture is the cultivation, processing and distribution of food within urban and suburban areas. One of the most promising forms of urban agriculture is vertical farming, a multi-level structure that allows plants to be grown in a controlled environment.

The growing urban population (more than 68% of the world's population is expected to live in urban areas by 2050, according to the UN, 2019) and the shortage of arable land are driving the search for innovative agricultural technologies to ensure food security within urban areas.

Modern urban agriculture is based on the use of high-tech methods, they are: *hydroponics* - growing without soil, in a water solution with mineral fertilisers; *aeroponics* - spraying a nutrient solution directly onto roots suspended in the air; *Controlled Environment Agriculture* (CEA) - the use of LED lighting, temperature, humidity and CO_2 sensors to optimise growth conditions; *integrated nutrition systems* - a combination of aquaculture and crop production (aquaponics). These technologies ensure high water and resource efficiency: for example, vertical farms consume up to 95% less water than traditional agriculture (Despommier, 2020).

The development of urban agriculture has a number of strategic benefits for the food systems of the future. In the context of global warming, urbanisation, water scarcity and the growing demand for fresh food, growing food directly in cities can address a number of social, economic and environmental challenges.

One of the key advantages of urban agricultural production is the efficient use of limited urban space. In particular, vertical farms, roofs, basements, building walls

or even shipping containers can be transformed into agricultural production facilities. This is especially important in densely populated megacities, where every square metre of land is at a premium (Specht, K., et al., 2014).

The other key advantages of urban agricultural production we have highlighted in the Tab. 1.

Table 1. Key Advantages of Urban Agriculture

Advantage	Description
Efficient use of space	Cultivation possible in multistory buildings, rooftops, basements, containers.
Reduced logistics costs	Proximity to consumers minimizes transport, storage, and refrigeration needs.
Lower CO_2 emissions	Less transportation means fewer greenhouse gas emissions.
Efficient water use	Up to 95% water savings through hydroponic and recirculating systems.
Year-round production	Controlled environment enables continuous cultivation regardless of season.
High crop yields	Up to 10–30 times more produce per m^2 than traditional farming.
No pesticides	Enclosed systems eliminate the need for chemical pest control.
Improved food security	Local production reduces reliance on global supply chains, especially in crisis.
Creation of new jobs	Emerging sectors create employment in agri-tech, logistics, and engineering.
Educational and social impact	Urban farms support community learning and social integration initiatives.

Thus, urban agriculture is not just an innovative form of cultivation, but a systematic approach to building sustainable food systems in the future. Its benefits are in line with the requirements of the UN Sustainable Development Goals (SDGs), in particular Goal 2: “End hunger”, Goal 11: “Sustainable urban development”, and Goal 13: “Combat climate change”.

However, research shows that with the increasing efficiency of LED technology and the development of renewable energy sources, vertical farming is becoming increasingly competitive (Benke & Tomkins, 2017).

For Ukraine, urban agriculture can be of strategic importance in the context of:

post-war urban reconstruction; limited access to arable land due to military operations; growing demand for safe food among the urban population.

Pilot projects are possible at universities, IT clusters, and industrial parks.

REFERENCES

1. Despommier, D. (2020). The Vertical Farm: Feeding the World in the 21st Century. Picador.
2. Benke, K., & Tomkins, B. (2017). Future food-production systems: vertical farming and controlled-environment agriculture. Sustainability: Science, Practice and Policy, 13(1), 13–26.
3. FAO. (2022). Urban agriculture: food, jobs and sustainable cities. https://www.fao.org/urban-peri-urban-agriculture/en
4. Specht, K., et al. (2014). Urban agriculture of the future: an overview of sustainability aspects of food production in and on buildings. Agriculture and Human Values, 31, 33–51.

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ВИКОРИСТАННЯ ВІДНОВЛЮВАНИХ ДЖЕРЕЛ ЕНЕРГІЇ У СИСТЕМАХ ЗРОШЕННЯ ПЛОДОВИХ КІСТОЧКОВИХ КУЛЬТУР ЯК ВІДПОВІДЬ НА ВИКЛИКИ ЕНЕРГЕТИЧНОЇ КРИЗИ ТА ЗМІНИ КЛІМАТУ В УКРАЇНІ

Галузь садівництва є однією з провідних для економіки України, забезпечуючи населення результатами сільськогосподарського виробництва та маючи значний потенціал експорту [2]. В умовах глобальних кліматичних змін, що проявляються у зростанні посушливості та нерівномірним розподілом опадів, отримання сталих врожаїв плодових, а зокрема кісточкових культур, стає майже неможливим без використання зрошення [6]. Ця потреба лише посилюється з плином часу. Водночас, повномасштабна війна спричинила значні руйнування енергетичної інфраструктури України, що викликало дефіцит та нестабільність у електропостачанні [1]. Дана ситуація ставить під загрозу роботу залежних від

енергії систем зрошення, тож це є актуальним та невідкладним викликом аграрному сектору. Традиційні види зрошення потребують значних енергетичних витрат для роботи насосних станцій [3]. Залежність від мережевої електрики або дизельних генераторів створює ризики перебоїв під час проведення поливів, має екологічні та економічні недоліки. Ефективне зрошення включає в себе також управління якістю води, що має значний вплив на ґрунт і рослини, що в свою чергу аналогічно вимагає стабільного енергопостачання для систем фільтрації чи автоматики [4]. В умовах зростаючої потреби у зрошенні та нестабільного енергозабезпечення актуальним є пошук надійних та постійних джерел енергії.

Відповіддю на ці виклики є використання відновлюваних джерел енергії (ВДЕ), таких як сонячна та вітрова. ВДЕ є безпечною енергією, що зменшує навантаження на довкілля та сприяє збереженню ресурсів. Для зрошуваного землеробства ВДЕ забезпечують енергетичну незалежність та стабільність роботи систем, зменшуючи залежність від централізованих постачальників. Сонячні ФЕС, зокрема гібридні системи, та частотні перетворювачі, для живлення насосів напряму від панелей, є ефективними в умовах нестабільних мереж та мають широке поширення в сільському господарстві. Вітрові установки також є джерелом енергії, а дані швидкості вітру в регіонах підтверджують їх потенціал. Для подолання моментів мінливості ВДЕ можуть бути використані акумулятори або, що доцільніше з економічної точки зору для зрошення, накопичення води спеціальними резервуарами [5].

Впровадження ВДЕ у процеси систем зрошення зокрема кісточкових культур має значні переваги. Воно підвищує стабільність поливних систем, оскільки гарантує надійне енергопостачання для насосів, критично важливе для своєчасного зрошення в умовах посухи та перебоїв у електромережі. Це, у свою чергу, забезпечує сталість врожаю, що сприяє продовольчій безпеці. ВДЕ також підвищує екологічність процесу. По-перше, це використання чистої енергії без шкідливих викидів. По-друге, стабільне живлення від ВДЕ дозволяє надійніше експлуатувати водозберігаючі системи (як приклад системи краплинного

зрошення) та обладнання для управління якістю води (фільтрації). Якість зрошувальної води (вміст солей, pH) суттєвим чином впливає на стан ґрунту та засвоєння поживних речовин сільськогосподарськими культурами. Надійна робота систем підготовки води та точного внесення добрив, що живляться від ВДЕ, дозволяє підтримувати оптимальний стан ґрунту та запобігати його деградації, що є важливим екологічним аспектом для аграрної країни. Незважаючи на початкові інвестиції, термін окупності яких може сягати десятка років, довгострокові вигоди від стабільності роботи та зменшення експлуатаційних витрат, особливо в умовах війни та відновлення, роблять ВДЕ досить привабливим рішенням.

Використання ВДЕ у системах зрошення плодових кісточкових культур є обґрунтованою відповіддю одразу на декілька викликів – енергетичну кризу, спричинену війною, та зміни клімату. ВДЕ забезпечують енергетичну незалежність, необхідну для стабільного виробництва, зв той же час сприяючи екологічності процесу зрошення. Впровадження таких систем є перспективним напрямом для модернізації та відновлення аграрного сектору України, що підвищує його стійкість до майбутніх перешкод та сприяє сталому розвитку садівництва.

ЛІТЕРАТУРА

1. Karmazin, O., Petrenko, K., & Ivanchenko, I. (2025). ОЦІНКА ЕКОНОМІЧНОЇ ДОЦІЛЬНОСТІ ВИКОРИСТАННЯ ЕНЕРГІЇ СОНЦЯ ДЛЯ ЗАБЕЗПЕЧЕННЯ ПОТРЕБ В ЕЛЕКТРИЧНІЙ ЕНЕРГІЇ НАСОСНИХ СТАНЦІЙ. Vidnovluvana energetika, (1 (80)), 60-69.

2. Височанська, М. Я., & Зубченко, В. В. (2023). Еколого-економічні основи збалансованості розвитку садівництва України. Агроекологічний журнал, (3), 18-29.

3. Волошин, М. (2019). ВИКОРИСТАННЯ ВІТРОВОЇ ЕНЕРГІЇ ДЛЯ ПОТРЕБ ЗРОШЕННЯ.

4. Караєв, О. Г., Караев, А. И., & Одинцова, В. (2018). Захист кісточкових від погодних факторів.

5. Новацький, П. І. (2024). Розробка фотоелектричної водяної насосної установки для системи зрошення (Bachelor's thesis, Тернопільський національний технічний університет імені Івана Пулюя).

6. Чебан, С. Д. (2018). ЗРОШЕННЯ ПЛОДОВИХ НАСАДЖЕНЬ. In Інноваційні технології в рослинництві.

Управління та адміністрування: стратегічні рішення в мінливих умовах

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ATTRACTING INVESTMENT FOR UKRAINE'S FUTURE DEVELOPMENT

Strategic management is critical in the context of investment attraction to post-war reconstruction in Ukraine. Return to economic stability and growth after the war needs a structured approach that will be reassuring for the investors and facilitate effective resource allocation. Investors want to know where the opportunities lie, in which sector opportunities exist, and how their investment can assist in creating economic recovery as well as long-term sustainable growth. A well-defined strategy assists in defining recovery targets, identifying the most paramount investment requirements, and laying out the horizon of returns for stakeholders. Technology to energy, manufacturing, agriculture, and infrastructure, and investment in high-end sectors renders the economy stronger.

Apart from vision creation, institutional and legal pillars must be anchored to attract investment. Investors require predictability in which contracts are being met, in which government is stable, and where financial commitments are being held. Legal clarity and the institutional development that reinforces the rule of law help in generating investor confidence. Simplification of corruption and assuring policy-conducive policy can render Ukraine more desirable for international as well as domestic investors. An effective institutional framework ensures effective expenditure of reconstruction funds, resulting in economic recovery that is sustainable.

Risk management is also an essential part of strategic management of post-war investment in Ukraine. Rehabilitation from war involves inherent risks like uncertainty, damaged infrastructure, and security risks. Strategic management introduces policies

that minimize financial risks, like offering tax relief, loan guarantees, and investment capital specifically for post-war reconstruction. By minimizing the riskiness of investment, Ukraine is able to lure private sector investment and eliminate fear of volatility. Furthermore, possessing insurance mechanisms that protect investors from sudden interruptions is able to boost the attractiveness of investment opportunities.

Public-private partnerships (PPPs) also hasten Ukraine's recovery by uniting private sector knowledge and capital with state action. Mass-scale reconstruction efforts such as repairing infrastructures are highly costly and entail a lot of investment that will be hard for the government to fund alone. Private firms can help in renovating transport infrastructure, repairing energy lines, and rebuilding houses with long-term returns through collaborative planning. Sector-oriented investment promotion aims to enhance Ukraine's capacity to attract different sources of capital.

Certain sectors, such as agriculture, technology, renewable energy, and manufacturing, are the most prospective in relation to foreign capital attraction. Agriculture has been a reliable pillar of Ukraine's economy in the past, and innovation in farms is capable of enhancing its performance and export growth. The energy industry, and renewable energy industry in particular, is at the core of the goal of rejuvenating and decoupling reliance on foreign resources. The technology sector, with the help of the quality of Ukrainian talent, offers potential to transform Ukraine into an innovation hub. The manufacturing industry also offers potential to revive production capacity and build global value chains. Positioning Ukraine within the international economy is also strategic management's top priority. Establishing good trade policy and aligning legislation with world trends, particularly with the European Union, makes Ukraine a more stable economic partner. Building partnership with overseas markets supports investment and enables business to attract international capital. In expressing interest in economic modernization and trade liberalization, Ukraine can position itself as being capable of accepting long-term investment.

Restoring confidence is the most abstract but most important investment pull factor. Confidence that Ukraine will recover is what it requires for investors to invest.

Other than fiscal policy, social stability, anti-corruption drives, and security policies influence investor sentiment. Strategic management establishes measures such that not only are fiscal incentives utilized to recover, but also a system where businesses and investors feel safe. Effective communication policies are also necessary in this context, as investors must see genuine development to believe. Last but not least, strategic management is the foundation upon which Ukraine will be reconstructed from war. By opening up channels of investment, building institutional mechanisms, avoiding the risk, encouraging public-private partnership, and selling sectoral opportunities, Ukraine will be able to attract sustainable investments.

Strengthening global integration and rebuilding trust will also persuade investors to invest in the country's reconstruction. Adopting a whole-cycle strategy of strategic management, Ukraine will be able to create a sustainable economy that not only recovers from war-time challenges but flourishes in the decades ahead.

REFERENCES

1. Alekneviciene, V., Huzenko, I. Y., & Solianyk, L. H. (2022). Global trends in foreign investment and their role in the post-war reconstruction of Ukraine's economy. *Economic Bulletin of Dnipro University of Technology*, *77*, 77–89. https://doi.org/10.33271/ebdut/77.077

2. Riznyk, D. (2023). Perspectives for post-war recovery in ukraine in the sphere of attracting foreign direct investments. *Економіка розвитку систем*, *5*(1), 31–34. https://doi.org/10.32782/2707-8019/2023-1-5

3. *Ukraine's 'economic miracle' strategy: Roadmap for post-war recovery*. (б. д.). The Financial Analyst. https://thefinancialanalyst.net/2025/02/10/ukraines-economic-miracle-strategy-roadmap-for-post-war-recovery/

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THE ROLE OF EMOTIONAL INTELLIGENCE IN EFFECTIVE MANAGEMENT

In today's business world, technical skills are no longer enough to be a successful manager. Businesses are increasingly discovering that leadership demands emotional intelligence (EI) - the ability to perceive, manage, and influence emotions. Emotionally intelligent managers build healthier workplace relationships, improve team performance, and foster organizational success (Mayer et al., 2016). This article explains how to apply emotional intelligence to management, its essential components, and how it optimises leadership.

Daniel Goleman's emotional intelligence theory (Goleman, 2005) defines five main elements: self-awareness, self-regulation, motivation, empathy, and social skills. Of these, in the context of management, the most significant are self-awareness, managing office politics, and inspiring employees. While IQ is relatively fixed, EI can be trained, and hence is a top skill for gaining long-term leadership success.

D. Coleman has listed five components to EI:

1. Self-Awareness. Good managers understand their own emotional state, strengths, and weaknesses. Managers who are conscious of how their feelings influence their decisions can change their behaviour to achieve better results. For example, a manager who panics and makes rash decisions can train himself to stay calm and use logic. Such an understanding of themselves inspires teams to trust their leader.

2. Self-Regulation. Effective managers stay cool even when things go wrong. Having the ability to control emotions helps them from making bad decisions when pressured. When a manager stays cool during difficult situations, it makes workers feel

safe and keeps work flowing smoothly. It also helps in solving conflicts without being angry.

3. Motivation. Emotionally intelligent leaders motivate themselves, challenging themselves with yet achievable goals. Their passion is contagious, leading employees to strive for their best. They are not reliant on external rewards but create a purpose, leading to innovation and long-term dedication. Rewarding the success of teams strengthens a high work culture.

4. Empathy. Good managers hear what their employees have to say and try to see things from their perspective. This causes employees to feel valued. An example is that if a manager recognizes a person has too much work, they can help before the person gets overwhelmed. Knowing people also settles quarrels because the manager can see both sides of the story.

5. Social Skills. Highly EI managers can communicate well, build good relations, and motivate people in good directions. They network effectively, solve problems in an efficient manner, and build teams. They give constructive feedback, settle differences fairly, and encourage free speech. They build teams which work harmoniously towards company goals.

Companies with emotionally intelligent leaders have happier employees, fewer people quitting, and better results. Workers feel heard and respected, so they work harder. These leaders also create an environment where people feel safe sharing ideas, which leads to innovation.

On the other hand, low-EI managers have high employee turnover, unhappy employees, and lots of conflict. When employees feel undervalued, they don’t work as effectively, and the company spends more to hire new workers. Companies that don’t teach EI to managers risk falling behind competitors who do (Богучарова, 2015; Wong & Law, 2002).

While some people are born with higher EI, it can be developed with practice. Companies can foster development with:

- Providing Training Sessions: Conflict resolution, active listening, and self-awareness training sessions equip managers with interpersonal skills that can be improved.
- Providing Feedback: Continuous feedback helps leaders become aware of the impact their emotions have on others.
- Mindfulness Practice Increased: Meditation and journaling reflective practice enhance self-regulation.
- Leading by Example: Senior leaders with EI serve as role models for others to follow.

Emotional intelligence is no longer a “soft skill”, it is the key to successful leadership. Leaders who excel in self-awareness, self-regulation, motivation, empathy, and social skills make workplaces where people excel. With more stress on flexibility and humanness, EI makes a great leader outshine a very good one. Organisations prioritising emotionally intelligent leadership will not only raise performance but also maintain a sustained competitive advantage. Effective management in the future is strategic thinking and emotional intelligence leadership. Merging EI with leadership will allow managers to excel in challenges, inspire teams, and achieve long-term success.

REFERENCES

1. Богучарова, О. І. (2015). Емоційний інтелект як чинник ефективності прийняття управлінських рішень у системі державного управління. *Вісник Дніпропетровського університету. Серія: Психологія*, (вип. 21), 12–23.

2. Goleman, D. (2005). *Emotional Intelligence: Why it can matter more than IQ*. Audio Renaissance.

3. Mayer, J. D., Caruso, D. R., & Salovey, P. (2016). The ability model of emotional intelligence: Principles and updates. *Emotion Review*, *8*(4), 290–300. https://doi.org/10.1177/1754073916639667

4. Wong, C.-S., & Law, K. S. (2002). The effects of leader and follower emotional intelligence on performance and attitude. *The Leadership Quarterly*, *13*(3), 243–274. https://doi.org/10.1016/s1048-9843(02)00099-1

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THE ROLE OF DECENTRALIZATION IN PUBLIC ADMINISTRATION

Decentralization has long been recognized as a crucial element in the promotion of good governance, public administration efficiency, and democratic participation. It encompasses a range of processes, including political devolution, de-concentration, delegation, and the transfer of responsibilities to non-governmental organizations. By bringing decision-making closer to the people, decentralization fosters stronger institutional frameworks, enhances citizen participation, and builds partnerships among various stakeholders.

Over the years, policy makers, politicians, and development practitioners in both developed and developing nations have increasingly supported decentralization initiatives. These efforts have been driven by internal factors such as political demands for greater autonomy and external influences like international development agencies advocating for governance reforms. Despite varying degrees of success, decentralization remains one of the most widely pursued strategies to bolster democratic governance and improve public service delivery at the grassroots level.

Decentralization can take multiple forms, each with its own objectives and impact:

1. Political decentralization involves transferring political authority to elected local governments, enabling them to make autonomous policy decisions.

2. Administrative decentralization focuses on redistributing responsibilities and decision-making powers from central governments to regional and local administrative units. It is further divided into de-concentration (assigning administrative duties to regional branches of central government ministries), delegation (granting semi-autonomous organizations and agencies the authority to perform specific functions on

behalf of the government), fiscal decentralization, economic and market decentralization.

Benefits of decentralization in public administration are the following:

1. Strengthening democratic participation:

Decentralization fosters an inclusive governance system by providing institutional mechanisms for citizens to engage in decision-making. By empowering local communities, it encourages the development of democratic values and civic responsibility. As a result, decentralization enhances national political legitimacy and fosters greater political stability.

2. Enhancing government accountability and service delivery

A decentralized system enhances government accountability by fostering closer interactions between elected leaders and the local population. Citizens can directly assess and influence government performance leading to increased responsiveness from local officials.

3. Encouraging economic development and resource optimization

Decentralization allows local governments to harness local resources, promote entrepreneurship, and attract investments that align with regional development needs. By enabling subnational governments to design and implement localized economic policies, decentralization fosters economic diversification and competitiveness.

4. Reducing bureaucratic inefficiencies and strengthening local governance

One of the major drawbacks of centralized governance is excessive bureaucratic red tape, which hampers swift decision-making. It strengthens the capacity of local governments, encouraging them to become self-sufficient in managing essential services such as healthcare, education, and infrastructure development. Furthermore, decentralization facilitates better coordination between civil society organizations, local businesses, and government agencies, creating an integrated governance framework.

While decentralization presents numerous advantages, it also comes with certain challenges that must be addressed to ensure its success. Local governments may lack

the administrative and financial capacity to effectively implement decentralized responsibilities. Capacity-building programs are essential to equip local authorities with the necessary skills and resources. As for fiscal decentralization, it requires a well-defined revenue-sharing system to prevent over-reliance on central government transfers.

Central governments may be reluctant to relinquish control over decision-making and financial resources. Addressing political resistance through legislative frameworks and political will is necessary for successful decentralization.

4. Equity and Regional Disparities: Without proper planning, decentralization may exacerbate inequalities between regions. Ensuring balanced resource distribution and equitable development is vital to achieving inclusive governance.

5. Coordination and Oversight: Effective decentralization requires a robust system of checks and balances to prevent corruption and mismanagement at local levels. Strengthening transparency and accountability mechanisms is key.

To sum up, decentralization is a powerful instrument for enhancing democratic governance, improving service delivery, and fostering socio-economic development. By bringing government closer to the people, it strengthens citizen engagement, promotes efficient resource allocation, and reduces bureaucratic inefficiencies. However, its success depends on a well-structured implementation strategy that addresses capacity constraints, financial sustainability, and equity concerns. When properly executed, decentralization serves as a means to improve governance effectiveness and promoting a pluralistic, participatory democracy that benefits all members of society.

REFERENCES

1. Cheema, G. S., & Rondinelli, D. A. (2007). *Decentralizing Governance: Emerging Concepts and Practices*. Brookings Institution Press.

2. Faguet, J. P. (2012). *Decentralization and Popular Democracy: Governance from Below in Bolivia*. University of Michigan Press.

3. OECD. (2019). *Making Decentralization Work: A Handbook for Policy-Makers*. OECD Publishing.

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THE CREATIVE ECONOMY IN THE EVOLUTION OF ECONOMIC THOUGHT: A THEORETICAL PERSPECTIVE

The development of the creative economy as an object of theoretical and practical interest has intensified over the past two decades. Today, this sector is considered a significant driver of economic growth, employment, and innovation. However, despite its rapid institutionalization in policy and research, the theoretical foundations of the creative economy remain underexplored. This abstract aims to highlight how different schools of economic thought from early mercantilism to modern evolutionary economics have interpreted or could interpret the role of creativity, innovation, and culture in the economic system.

The relevance of this analysis is determined by the increasing influence of creative industries on GDP, global trade, and employment. According to UNESCO, cultural and creative sectors account for around 6.1% of global GDP and employ nearly 30 million people worldwide [7]. Yet the idea that creativity can generate economic value is not entirely new. Economic thought has long engaged directly or indirectly with themes of innovation, cultural production, and the economic role of knowledge.

The study shows that the mercantilist school viewed cultural and artisanal products primarily as tools of national prestige and trade advantage. Classical economists acknowledged human skill and technical improvement but excluded most cultural labor from productive categories [6]. Neoclassical theory, particularly through endogenous growth models, expanded the role of human capital and innovation, laying the groundwork for incorporating creative labor into formal growth theory [4].

The Keynesian approach, while centered on macroeconomic stability, recognized the role of public support for the arts, treating them as merit goods and sources of employment and identity during periods of crisis [1]. Austrian and Schumpeterian economists emphasized the role of the entrepreneur, the creative destruction mechanism, and the innovation cycle as central to economic development [5]. Institutional economists focused on the importance of legal frameworks, education systems, and norms in shaping the capacity for creative value creation [3]. Finally, evolutionary economics interprets the creative economy as a self-developing system where variation, selection, and diffusion of ideas determine long-term growth trajectories [2]. To summarize these perspectives, the table 1 outlines the contribution of each school in relation to innovation, human capital, and cultural value.

Table 1.

Interpretation of Creative Economy Elements by Economic Schools

School	Innovation	Human Capital	Cultural Value
Mercantilism	Supported if linked to trade benefit	Skilled artisans viewed instrumentally	Valued for prestige/export potential
Classical	Acknowledged but exogenous	Focused on productive labor only	Often excluded from value creation
Neoclassical	Central in modern growth theory	Recognized as capital input	Treated as consumer utility, with externalities
Keynesian	Indirect via public policy	Seen as employment and social good	Considered a merit good, justifying subsidies
Schumpeterian	Core driver of economic evolution	Entrepreneurs as innovation agents	Part of dynamic renewal and market disruption
Institutional	Shaped by laws and norms	Enabled through IP, education systems	Embedded in institutional and cultural context
Evolutionary	Continuous, endogenous process	Knowledge evolves via routines	Co-evolves with norms and technological change

Created by the author

This comparative framework highlights both continuity and divergence in how economic thought approaches creativity. Early schools such as mercantilist and classical recognized the economic value of cultural production mainly through trade and prestige but lacked a systemic understanding of creativity. In contrast, modern schools such as Schumpeterian, institutional and evolutionary emphasize innovation, human capital and cultural dynamics as central to economic development. This reflects a broader shift from viewing creativity as peripheral to recognizing it as essential to productivity and long-term growth.

In conclusion, the creative economy should not be regarded as disconnected from the history of economic thought. Instead, it reflects a gradual theoretical shift toward recognizing creativity, knowledge, and culture as essential economic assets. This understanding provides a valuable foundation for both modern policy formation and academic exploration.

REFERENCES

1. Keynes, J. M. (1982). *The collected writings of John Maynard Keynes: Vol. 28. Social, political and literary writings*. Cambridge University Press.
2. Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Harvard University Press.
3. North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
4. Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71–S102.
5. Schumpeter, J. A. (1942). *Capitalism, socialism and democracy*. Routledge.
6. Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. W. Strahan and T. Cadell.
7. UNESCO. (2022). *Promoting the diversity of cultural expressions and creative economy*. UNESCO Publishing. https://www.unesco.org/en/articles/promoting-diversity-cultural-expressions-and-creative-economy

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ЕТИКА УПРАВЛІННЯ БІЗНЕСОМ В УМОВАХ СУСПІЛЬНОЇ ТРАНСФОРМАЦІЇ

У контексті суспільних трансформацій етика управління розглядається як сукупність нормативно-моральних установок і стандартів поведінки керівників, що забезпечують відповідальне прийняття рішень у період соціальних, культурних та економічних змін. Вона є важливою складовою в умовах суспільної трансформації.

Суспільні трансформації зумовлюють істотні зрушення в соціальній структурі та трансформацію нормативно-правового середовища, про це свідчать ряд досліджень та науково-практичних праць. Варто зауважити, що кризи можуть спричинити дестабілізацію суспільства, похитнути моральні опори та соціальні орієнтири. Такі кризові ситуації вимагають від управлінців чіткої етичної позиції задля збереження стабільності та довіри суспільства [1, с. 165 – 166].

У сучасній науковій дискусії обговорюють вплив кризових явищ на психічний стан і поведінку індивідів. У своїй праці «Особистість в умовах суспільної кризи» Уварова С. Г. демонструє, як соціально-економічні та політичні трансформації формують емоційні реакції людей і модифікують їхні поведінкові наслідки та дії.

У статті висвітлюється, що раптові соціальні зміни та потрясіння викликають у людей тривогу, почуття безпорадності та руйнують бачення звичного. Такий виклик змушує управлінців брати до уваги психологічний стан суспільства при ухваленні тих чи інших рішень [1, с. 167 – 170]

Філіпова Н. В. у своїй роботі «Управління організацією в умовах цифрової трансформації», досліджує специфіку управлінських практик в умовах цифрових

змін. Автор розглядає адаптацію до нових цифрових технологій, а також акцентує на важливості підвищення рівня цифрової грамотності серед керівників та співробітників для успішного переходу до нових технологій і моделі управління.

З аналізу наукової літератури можна стверджувати, що цифрова трансформація змушує управлінців не тільки впроваджувати технічні інновації, а й етично переосмислювати та змінювати підходи до комунікації, збереження захисту інформації та забезпечення справедливості в умовах швидкого розвитку цифрової реальності.

Така реальність робить необхідним більш глибоке осмислення ролі етичних стандартів у нових умовах управління. У цьому контексті цифрова трансформація не лише змінює технологічний ландшафт, а й висуває нові вимоги до управлінської етики. Варто зазначити, що надзвичайно важливим стає принцип прозорості прийняття рішень та інформаційної відкритості в умовах цифрової економіки, що стає новим етичним викликом для діяльності управлінців [2, с. 2 – 5].

Науковці аналізують етику управління як комплекс моральних принципів та норм, що визначають поведінку управлінців у процесі прийняття рішень та здійснення управлінської діяльності, особливо в умовах соціальних, економічних та політичних трансформацій.

В наукових дискусіях постає питання, які фундаментальні засади повинні лежати в основі сучасних моделей економічного розвитку підприємств. У цьому контексті Чичун В. А. наголошує на тому, що для побудови підґрунтя сучасних моделей економічного розвитку підприємств мають слугувати основи сталості, соціальної відповідальності та розвитку людського потенціалу, що має безпосередній вплив на етичні стандарти управління [3, с. 298 – 300].

Сучасні управлінці мають усвідомлювати, що прийняття рішень не може обмежуватись лише окремими аспектами. Важливо, щоб ці рішення враховували соціальні наслідки та їхній вплив на людство в цілому. В умовах суспільної

трансформації етика управління набуває особливого статусу не лише системи стандартів поведінки для керівників, а й основи для формування здорового та справедливого суспільства, здатного долати трансформаційні виклики без значних соціальних потрясінь.

Розуміння етичних засад у період суспільних змін стає основою для збереження соціальної єдності, стабільності та довіри до рішень управлінця [1, с. 167].

Таким чином, етика управління в умовах суспільної трансформації є одним із визначальних факторів, що впливають на успіх або провал трансформаційних процесів. Вона повинна ґрунтуватися на принципах справедливості, прозорості, соціальної відповідальності, взаємоповаги та збереження моральних цінностей, які становлять основу гармонійного розвитку суспільства в умовах змін. Лише в такому випадку можливе забезпечення сталого розвитку, соціальної стабільності та підтримки довіри до органів влади та інститутів управління в періоди значних суспільних змін.

ЛІТЕРАТУРА

1. Уварова, С. Г. (2016). Особистість в умовах суспільної кризи. *Психологія і особистість*. 1 (9). 163–173.

2. Філіпова, Н. В. (2025). Управління організацією в умовах цифрової трансформації. *Bulletin of the Academy of Labor, Social Relations and Tourism. Series: Economics, Psychology and Management*. 3. URL: https://doi.org/10.54929/3041-2390-2025-03-04-01 (дата звернення: 24.04.2025).

3. Чичун, В. А. (2018). Особливості управління економічним розвитком сучасного підприємства в умовах трансформації економічного середовища. *Вісник Чернівецького торговельно-економічного інституту. Економічні науки*. 1/2 (69/70). 297–302.

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GOVERNANCE OF THE STATE IN TIMES OF WAR

A military conflict becomes a serious challenge for any state, requiring the government to make quick and effective decisions covering all aspects of public life. Public administration in times of war involves flexible use of resources, ensuring defence capability, supporting the economy and social sphere, as well as effective communication both domestically and internationally. In the period since 2014, and especially after the full-scale invasion in 2022, Ukraine has faced unprecedented challenges that required mobilisation of all possible resources and a radical revision of management strategies.

In wartime, the Ministry of Defence of Ukraine is one of the key priorities of public administration. It has demonstrated an example of effective mobilisation of the army and the formation of a multi-level defence system, including regular armed forces, territorial defence forces and volunteer units. The important role is played by cooperation between the army, government and society, which ensures a comprehensive approach to defending the country. It is worth emphasising that since 2014, the number of Ukrainian troops has increased significantly, and their training and equipment standards have approached the level of NATO armies [6].

Government institutions need to coordinate and make quick decisions in times of war. Digitalisation of government processes is crucial in the context of hostilities, enabling rapid information processing and decision-making. Meanwhile, Ukraine has become one of the first countries to actively use e-government in a military environment: the Diia mobile app not only provides citizens with access to documents but also serves as a rapid alert and data collection tool for hostile actions [1].

Whenever there is a war, there are significant economic losses, and Ukraine is no exception. According to the World Bank, Ukraine's GDP declined by 29.1% in 2022. Economic recovery is only possible with comprehensive state support for entrepreneurship and international assistance [7]. According to the government, one of the key decisions was to create a financial support programme for small businesses, which allows entrepreneurs to continue operating even under martial law. In addition, international assistance plays a crucial role in stabilising the financial situation: Ukraine has received tens of billions of dollars in aid from the US, EU, Canada and other partners [2].

In addition, the war has caused large-scale humanitarian challenges: millions of citizens have been internally displaced, and hundreds of thousands have lost their homes and jobs. For example, as of 2023, more than 8 million Ukrainians were forced to seek refuge abroad. The state has implemented a number of support programmes for the victims, including payments to internally displaced persons, compensation for destroyed housing, and psychological rehabilitation for military and civilians. Programmes run by organisations such as the UN, Red Cross and the EU help to meet the basic needs of the population in the war zone [3].

While information warfare has become an integral part of modern conflicts, Ukraine is actively countering disinformation. Russia uses large-scale information campaigns, spreading fake news, distorting the reality of events and trying to discredit the Ukrainian government in the international arena [3]. Engaging social media, TV channels and propaganda agencies has become the main tool of information influence. Consequently, Ukraine has created a number of initiatives to refute fakes and debunk disinformation, including official resources, volunteer fact-checking projects, and the active work of the Ministry of Digital Transformation.

However, diplomacy plays a critical role in the conflict resolution process. Increased diplomatic relations with partner countries have allowed for the supply of weapons, financial support and humanitarian aid. The Ukrainian authorities are actively cooperating with international organisations such as the UN, NATO and the

EU to increase sanctions pressure on Russia and to ensure political support for Ukraine in the world. Presidential addresses, official visits and meetings with Western leaders play a crucial role in shaping the strategy for protecting national interests [5, 6].

In conclusion, we believe that effective governance in wartime requires quick decisions and a comprehensive approach to all spheres of public life. Ukraine has demonstrated the ability to mobilise resources, reform the defence sector and digitalise public administration. Despite significant economic and humanitarian losses, the government is actively supporting businesses and the affected population, and international assistance plays a fundamental role in the country's financial stability. Simultaneously, information warfare and diplomacy remain important tools for protecting national interests, countering hostile propaganda, and strengthening cooperation with international partners.

REFERENCES

1. Diia. (2023). Digital Governance in Wartime: Ukraine’s Experience. Ministry of Digital Transformation of Ukraine. Retrieved from https://diia.gov.ua
2. European Commission. (2023). EU Financial Assistance to Ukraine in Response to the War. Retrieved from https://ec.europa.eu
3. Institute for the Study of War (ISW). (2023). Russia’s Information Warfare Tactics and Ukraine’s Response Strategies. Retrieved from https://www.understandingwar.org
4. International Committee of the Red Cross (ICRC). (2023). Humanitarian Assistance in Ukraine: Addressing the Needs of Conflict-Affected Populations. Retrieved from https://www.icrc.org
5. Ministry of Defense of Ukraine. (2023). Defense Strategy of Ukraine: Key Developments Since 2014. Retrieved from https://www.mil.gov.ua
6. NATO. (2023). Ukraine and NATO: Strengthening Defense Cooperation. Retrieved from https://www.nato.int
7. World Bank. (2023). Ukraine Economic Update – Fall 2023. Retrieved from https://www.worldbank.org

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FRENCH CLIMATE LEADERSHIP AND POLICY

The economic policy of the state is a key tool for managing the national economy, aimed at achieving stability, growth and social well-being. Its effectiveness is often debated, as its impact extends beyond the economic sphere to influence social, institutional and environmental dimensions. In modern times, with such challenges as economic crises, social inequality, climate change, and institutional modernization, assessing the impact of economic policies has become crucial. Effective measures can foster sustainable development, while shortcomings may exacerbate existing issues.

In 2023, French President Emmanuel Macron enacted pension reforms, raising the retirement age from 62 to 64. These changes sparked widespread protests but were deemed necessary to address a projected pension fund deficit of €20 billion by 2030. Starting in 2027, the minimum work tenure for full pension eligibility will increase to 43 years, with a minimum monthly pension of €1,200. Critics highlight its adverse effects on vulnerable groups, including manual laborers, women and part-time workers. Currently, only 56% of those aged 55–64 in France are employed, and for people aged 60–64 the employment drops to 35%. While controversial, the reform aims to ensure long-term financial stability [4].

The Paris Climate Agreement, signed by 195 countries and ratified by 186, including Ukraine, the aims to limit global warming to 1.5–2 degrees Celsius above the pre-industrial levels. Each nation commits to reducing greenhouse gas emissions through Nationally Determined Contributions, reviewed every five years [3] . France also implemented the Law on Energy Transition for Green Growth, which states the following [3]:

- 32% share of renewable energy by 2030;
- 50% reduction in energy consumption by 2050;
- Phasing out nuclear power plants and promoting solar and wind energy investments.

France plans to ban gasoline and diesel cars by 2040, and it outlawed single-use plastic products, emphasizing recycling and sustainable materials in 2020. The issuance of green bonds funds eco-friendly projects like renewable energy development and infrastructure modernization. These efforts place France at the forefront of the global green transition. France has undertaken labor reforms to increase flexibility, reduce unemployment, and promote growth of economy. In 2017, reforms introduced under Macron simplified dismissal procedures and cut hiring costs for employers. Additional measures included training programs and subsidies for the long-term unemployed and youth, promoting re-skilling and workforce integration. These reforms have the aim to foster equality and competitiveness in the labor market, reduce unemployment and improve economic resilience [6]. France's tax system includes both direct and indirect taxes supporting public services like healthcare and education. Key taxes include the following taxes:

1.Personal income tax, with progressive rates up to 45%;

2. Corporate income tax, reduced from 33.33% to 25% by 2022;

3. Value-added tax (VAT) at 20%, with reduced rates for essential goods [6].

Recent reforms under Macron reduced tax burdens for businesses and the middle class, alongside measures during the COVID-19 pandemic, such as tax deferrals and direct payments to companies. France also introduced green taxes to incentivize sustainable practices and CO2 reductions. France faces a demographic crisis with only 678,000 births recorded in 2022. It is the lowest birth rate since 1946. Experts attribute this to structural issues and reduced support for family policies under previous administrations. High living costs, expensive childcare, and limited housing exacerbate the problem. Although reforms for maternity leave and infertility support have been announced, French implementation remains slow and France can lose the position of

the European leader in birth rates [5]. Despite being the EU leading agricultural producer, France's agricultural policies face significant challenges. Large-scale agribusiness dominance has marginalized small farmers, who struggle with high costs for land and equipment. Subsidies favor large operations, neglecting sustainable practices for small and medium farms. Intensive farming and inadequate regulation lead to soil degradation and water pollution. Land access is restricted by high prices, and limited support for young farmers hampers sector renewal. The demographic crisis further exacerbates the lack of agricultural labor [1]. Economic policy plays a key role in shaping societal and environmental outcomes. France's efforts in pension reform, green initiatives, labor market adjustments and tax reforms demonstrate a commitment to long-term stability and sustainability. However, areas like demographic and agricultural policy reveal significant shortcomings, requiring more holistic and inclusive strategies. By addressing these gaps, France and other nations can better navigate modern challenges and foster sustainable, equitable growth.

REFERENCES

1. BBC. URL: https://www.bbc.com/ukrainian/features-51157111 (access date: 01.21.2025).
2. DW. URL: https://www.dw.com/uk/ (access date: 01.21.2025).
3. Greendeal. Paris climate agreement. URL: https://greendeal.org.ua/paryzka-klimatichna-ugoda/ (access date: 01.21.2025).
4. Pension reform: why are people protesting in France. URL: https://socsprava.com.ua/pensijna-reforma-chomu-protestuyut-u-francziyi/(access date: 01.21.2025).
5. Polskie radio. URL: https://www.polskieradio.pl(access date: 01.21.2025).
6. USAID. URL: https://pdf.usaid.gov/pdf_docs/PA00ZKX1.pdf (access date: 01.21.2025).

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ФОРМУВАННЯ ЕФЕКТИВНОЇ ПОЛІТИКИ УПРАВЛІННЯ ВИТРАТАМИ НА ОСНОВІ АНАЛІЗУ ЗВІТУ ПРО ФІНАНСОВІ РЕЗУЛЬТАТИ (НА ПРИКЛАДІ ТОВ «МЕТІНВЕСТ ХОЛДИНГ»)

В умовах економічної нестабільності процес контролю за витратами набуває особливої ваги як фактор зміцнення фінансової стійкості та сталого функціонування підприємств. Розробка ефективної стратегії управління ресурсами, що базується на детальному аналізі показників, дозволяє вдосконалити виробничі процеси, скоротити необґрунтовані витрати та значно підвищити рентабельність. Саме Звіт про фінансові результати (Звіт про сукупний дохід) є незамінним інформаційним інструментом для прийняття виважених управлінських рішень, адже він відображає реальний економічний стан компанії та дає змогу своєчасно коригувати фінансову політику.

Актуальність та релевантність даного дослідження полягає у необхідності вивчення методів та інструментів формування ефективної політики управління витратами на основі аналітичних даних фінансової звітності установ гірничо-металургійного сектору в умовах нестабільності фінансових потоків.

Метою дослідження є формування практичних рекомендацій з впровадження механізмів бюджетного регулювання для підвищення ефективності діяльності підприємства на основі всебічного аналізу структури та динаміки витрат за 2020–2024 рр.

Об’єктом вивчення обрано ТОВ «Метінвест Холдинг» - міжнародну вертикально інтегровану групу компаній, що здійснює повний виробничий цикл: від видобутку залізної руди та вугілля до виготовлення напівфабрикатів і готової металопродукції, а також оперативно постачає сировину й готові вироби на

світові ринки [1]. Задля реалізації визначеної мети здійснено оцінку змін у витратній структурі (див. табл. 1).

Таблиця 1 - Аналіз структури і динаміки витрат ТОВ «Метінвест Холдинг» за 2020–2024 рр. [2]

Назва статті	***Показник***	***2020 р.***	***2021 р.***	***2022 р.***	***2023 р.***	***2024 р.***
Собівартість реалізованої продукції (товарів, робіт, послуг)	Сума, тис. грн.	20 104 883	58 290 875	13 047 994	18 313 599	16 930 625
	Питома вага, %	82,98	90,63	67,95	83,73	72,34
Адміністративні витрати	Сума, тис. грн.	2 433 468	4 222 532	2 677 051	1 983 692	2 266 676
	Питома вага, %	10,04	6,57	13,94	9,07	9,68
Витрати на збут	Сума, тис. грн.	358 792	513 719	617 477	755 847	1 395 468
	Питома вага, %	1,48	0,8	3,22	3,46	5,96
Інші операційні витрати	Сума, тис. грн.	1 330 758	1 287 518	2 859 217	819 002	2 812 603
	Питома вага, %	5,49	2	14,89	3,74	12,02
Разом витрат	Сума, тис. грн.	24 227 901	64 314 644	19 201 739	21 872 140	23 405 372
	Питома вага, %	100	100	100	100	100
Чистий дохід від реалізації продукції (товарів, робіт, послуг)	Сума, тис. грн.	24 774 879	62 961 687	16 324 678	22 832 982	24 481 196
Витрати на 1 грн. чистого доходу	Сума, грн.	0,81	0,93	0,79	0,80	0,69

Упродовж досліджуваного періоду показники фінансової звітності ТОВ «Метінвест Холдинг» демонструють нестабільну динаміку. У 2020 році структура затрат характеризувалася високою часткою собівартості реалізованої продукції, що є типовим для підприємств з високою матеріаломісткістю виробництва. А 2021 рік відзначився стрімким зростанням як загальних витрат, так і чистого доходу, що стало результатом розширення ринків, підвищення цін на метал та інвестицій у модернізацію виробничих потужностей. Різке погіршення показників у 2022 році стало безпосереднім наслідком

повномасштабного російського вторгнення в Україну, яке призвело до збоїв у логістичних ланцюгах, скорочення попиту на металургійну продукцію та обмеження експортних можливостей. Натомість збільшення частки адміністративних та збутових витрат у цей період відображає необхідність реорганізації управлінських процесів (див. рис. 1).

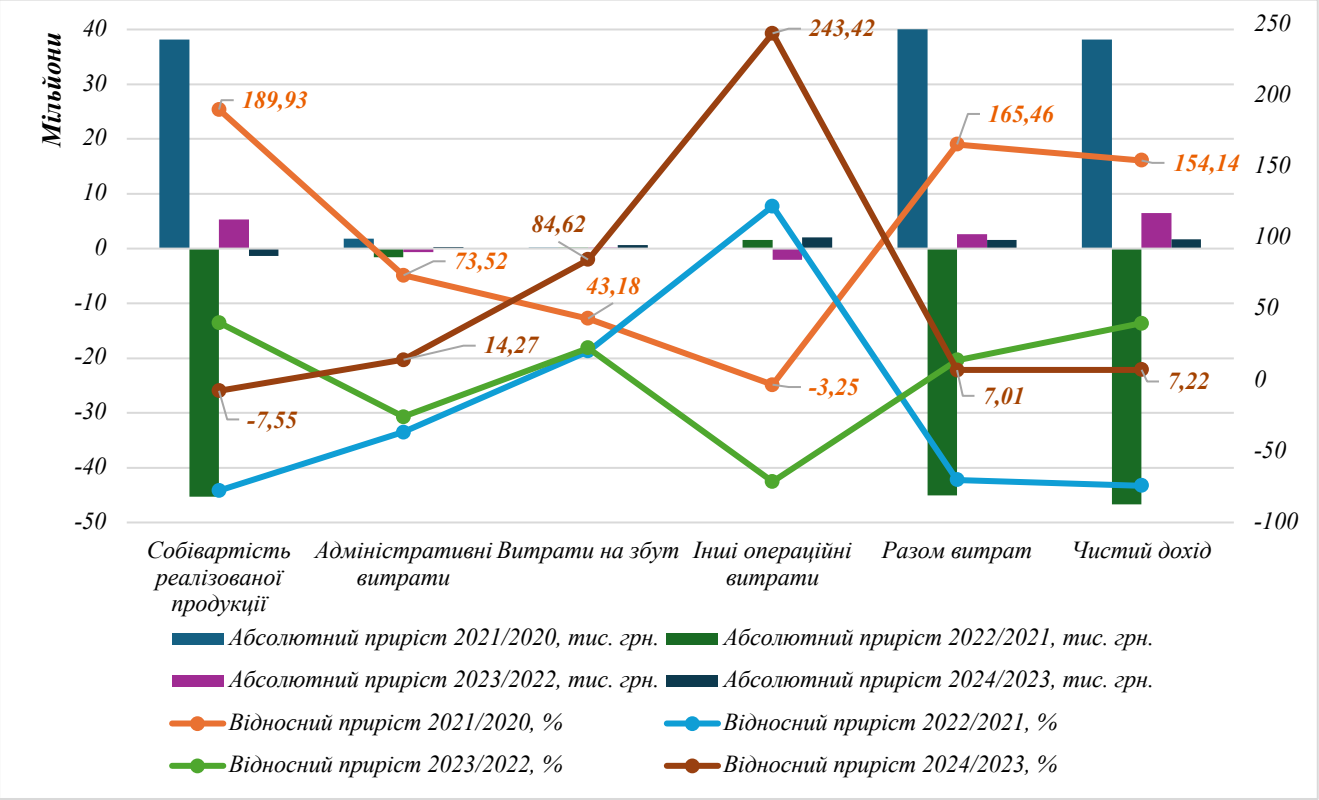

Рисунок 1 - Порівняльна оцінка абсолютних величин та темпів зростання витрат ТОВ «Метінвест Холдинг» за 2020–2024 рр. [створено автором]

У 2023 році підприємство демонструє ознаки відновлення: загальна сума витрат зростає, а структура стабілізується — зменшується питома вага непрямих видатків, натомість поліпшується частка основного виробництва та збільшення відсотку затрат на видобуток руди й виплавку сталі. Це стало наслідком відмови від малорентабельних проєктів і раціоналізації внутрішніх процесів, що дозволило інвестувати в удосконалення збагачувальних фабрик і сталеплавильних цехів. Незважаючи на подальше посилення операційних і збутових витрат, зниження витратності на кожну гривню доходу до 0,69 грн стало свідченням покращення ефективності використання ресурсів у 2024 році. Така

динаміка досягнута завдяки реалізації низки оптимізаційних заходів, серед яких централізація закупівель та впровадження цифрових рішень для управління виробництвом, що дозволило зберегти прибутковість попри стрімкий ріст окремих статей витрат фінансової звітності.

Таким чином, результати дослідження вказують на доцільність впровадження заходів з оптимізації витрат, раціонального перерозподілу ресурсів та активізації прибуткових напрямів діяльності ТОВ «Метінвест Холдинг». Насамперед варто посилити контроль та шукати можливості скорочення адміністративних і супутніх операційних витрат, які значно зросли у період 2020–2024 років. З огляду на вищезазначене доцільно провести комплексний аудит відповідних статей витрат з метою виявлення резервів їх оптимізації без негативного впливу на управлінські процеси та ключові економічні показники. Зниження затрат на збут, які також зазнали суттєвого приросту, може бути досягнуто шляхом перегляду маркетингової стратегії, вдосконалення логістичних процесів та налагодження продуктивнішої взаємодії з партнерами. Не менш значущим є стримування зростання собівартості продукції, що реалізується, через поліпшення системи закупівель сировини й матеріалів, а також підвищення інтенсивності виробництва. Підсумовуючи, слід відзначити, що стратегічна орієнтація на сталий розвиток у поєднанні з впровадженням енергоефективних підходів є невід’ємним елементом зміцнення господарської спроможності підприємства. Реалізація таких заходів не тільки сприяє зниженню експлуатаційних витрат, але й дозволяє оптимізувати процеси бюджетного регулювання, що в свою чергу зміцнює конкурентні позиції компанії на ринку.

ЛІТЕРАТУРА

1. Про компанію – Метінвест. *International Mining and Steel Manufacturing Group of Companies*. URL: https://metinvestholding.com/ua/about (дата звернення: 25.04.2025);

2. 34093721 – ТОВ «МЕТІНВЕСТ ХОЛДИНГ» - Фінансова річна звітність. *Clarity Project*. URL: https://clarity-project.info/edr/34093721/yearly-finances (дата звернення: 25.04.2025).

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RISK MANAGEMENT IN THE INTERNATIONAL SUPPLY CHAIN

The transport and communication complex is a complex dynamic system, which forms a single, stable and interconnected structure that functions under the influence of many factors. The state of this complex significantly affects the development of other sectors of the economy, the formation of gross domestic product, since they have an integral nature and penetrate into various sectors of the economy.

International transport services, being a specific product, are sold and purchased on international transport markets, which differ depending on the types of transport, geographical areas of transportation and types of transported cargo. Transport services include services related to the delivery of goods to the customs border of the importing country and the destination of the cargo, ensuring the functioning of the transport infrastructure (loading and unloading operations, services of ports, stations, transport agencies, customs brokers, etc.). Widespread application of new logistics concepts can reduce logistics costs and improve the overall efficiency of trade.

The system of organizing people, activities and resources includes a supply chain, logistics chain or supply network. All of them participate in the transfer of a product or service from the supplier to the consumer. The supply chain process helps to transform raw materials and components into a finished product that is delivered to the end consumer.

A typical supply chain begins with the extraction of raw materials and includes several production links, several stages of warehousing and, finally, reaching its consumer.

In the international supply chain of goods to the consumer of the domestic market, the manufacturer of the goods, exporter, carrier and importer usually participate. In many supply chains the organization of customs clearance and customs control is of key importance both during the export/import of goods and during their transit through the customs territory of a state or union of states. Regardless of the composition of the participants in the international supply chain, each participant must guarantee the security of his link for the customs authorities [1].

At the present stage, the issue of protecting the international supply chain from terrorism is of great concern to the world community, and considerable attention is paid to security issues. The world trading system is very vulnerable to terrorist attacks, which can cause serious damage to the entire world economy [2].

Risk management is the identification of risk and the implementation of all measures necessary to limit its impact. The processes of risk analysis and risk management are combined into a single system. The main links of the international supply chain of goods are interconnected with the risk analysis and management system. It is necessary to analyze and characterize each element of this system taking into account the links of the international supply chain of goods: the manufacturer, exporter, carrier, importer or owner of a warehouse where goods are stored under customs control. An additional connecting link between the exporter and the carrier may be a freight forwarder or agent. Problematic issues regarding the identification of risks of conducting foreign economic activity and the analysis of their negative impact are studied, for example, in scientific work [3].

Information for conducting risk analysis of the international supply chain of goods contains the following data : goods under customs control; product code according to the Ukrainian Classification of Economic Activities; country of origin of goods; country of departure and destination of goods; vehicle and route of movement of goods; customs value; exporter, importer (seller, buyer), agent, etc.; activities of declarants and other persons with authority in relation to goods under customs control; information contained in transport, commercial, customs and other documents;

documents provided for customs clearance, including information in foreign economic agreements (contracts) and/or documents confirming the right to own, use and/or dispose of goods; results of using forms of customs control, etc. Further analysis helps to identify sources and circumstances of potential risk, identify potential risk. Based on the results of risk analysis the priorities are formed, after that the next element of the system begins to operate, namely, risk management in order to minimize them.

The use of comprehensive risk analysis and management system provides a number of advantages for all participants in the process of foreign trade activities. Along with other advantages, it allows to optimize transport and customs technologies and procedures for ensuring cargo transportation. The risk analysis and management system may be in selecting goods and vehicles with a high degree of risk for control, in choosing the most appropriate forms of customs control to confirm or refute information about potential risks. That is, it acts as an effective and efficient mechanism for implementing a safe supply chain for goods circulating in international trade.

REFERENCES

1. Мацкевич В. (2008) Обеспечение безопасности цепи поставок товаров в ЕС. *Таможня и ВЭД*. № 11. С. 13-15.

2. Денисенко С.І. & Ільченко О.В. (2023) Система джерел міжнародно-правового регулювання спрощення та гармонізації митних процедур у сфері міжнародної торгівлі. *Юридичний науковий електронний журнал.* № 11. DOI https://doi.org/10.32782/2524-0374/2023-11/154.

3. Пісной П. (2008) Управління митними ризиками як один із методів забезпечення митної безпеки держави. *Вісник Національної академії державного управління при Президентові України*. № 2. С. 177-186.

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THE ROLE OF ACCOUNTING IN BUSINESS DECISION-MAKING

Accounting is the foundation of informed business decisions, driving success, and sustainability through financial insights. Financial analysis evaluates performance and aids strategic planning, helping companies set short- and long-term goals. By focusing on these key areas, businesses can improve decision-making and overall outcomes. Understanding the value of accounting allows businesses to adapt, thrive, and shape their future [1].

One of the most important statements is balance sheet. It is snapshot of a company's assets, liabilities, and equity at a specific point in time. Balance sheet helps assess financial position and solvency.

As for income statement, it reports a company's financial performance over a period of time, showing revenues, expenses, and net income. It is crucial for evaluating profitability.

Cash flow statement tracks the movement of cash both into and out of a company, categorized by operating, investing, and financing activities. It is essential for assessing liquidity.

Financial statements are crucial for stakeholders: investors, creditors, and managers—to assess a company's financial health and make informed decisions. Their effective use is key for strategic planning and resource allocation [2].

A key set of financial metrics includes liquidity, profitability and solvency ratios. Liquidity ratios measure a company's ability to meet its short-term obligations. Examples include the current ratio and quick ratio, which indicates financial stability and operational efficiency.

As for profitability ratios, they assess a company's ability to generate earnings relative to its revenue, assets, or equity. They include metrics like gross profit margin and net profit margin and reflects business performance.

Solvency ratios evaluate a company's long-term financial stability and its ability to meet long-term obligations. Examples include the debt-to-equity ratio. Besides, solvency ratios ensure long-term operational sustainability.

Analyzing these financial ratios helps businesses understand their efficiency, profitability, and financial health, providing a framework for benchmarking and data-driven decisions [3].

A fundamental group of financial metrics comprises cost-benefit analysis, risk assessment, and risk mitigation. Cost-benefit analysis evaluates the financial viability of a project or investment by comparing expected costs and benefits. This method is essential for efficient resource allocation.

When it comes to risk assessment, it identifies potential threats to a business, evaluates their likelihood and impact, and develops strategies to mitigate them. This process is crucial for business continuity.

Risk mitigation involves implementing measures to minimize the impact of identified risks, such as insurance, diversification, or hedging. Besides, it enhances operational resilience.

Effective cost-benefit analysis helps prioritize projects that offer the highest returns, while robust risk management safeguards the business from potential threats. These practices are crucial for ensuring sustainable growth and protecting shareholder value [4].

A crucial set of financial technologies encompasses cloud accounting, automation, and data analytics. Cloud accounting provides real-time access to financial data, enhances collaboration, and reduces IT costs. This technology facilitates seamless data integration.

Data analytics leverages advanced tools to extract insights from financial data, enabling improved forecasting and decision-making. It provides valuable insights that drive business growth.

The digital age is transforming accounting, making it more efficient, accurate, and strategic. Embracing technology is crucial for businesses to stay competitive and make informed decisions. The future of accounting lies in leveraging technology to drive value and improve outcomes [5].

An essential member of any company, the accountant plays a crucial role in ensuring financial health and stability. Accountants manage financial records, prepare reports, and ensure tax compliance. They provide insights that support decision-making, helping businesses allocate resources and plan for growth.

Their expertise in budgeting, forecasting, and financial analysis enables informed strategic decisions, risk management, and profitability optimization.

To sum up, accountants are indispensable to a company's success ensuring operational efficiency, financial transparency, and sustainable growth. Accountants also serve as trusted advisors contributing to long-term financial planning.

REFERENCES

1. Understanding Accounting Principles: The Foundation Of Financial Management. URL: https://holistiquetraining.com/public/en/news/the-foundation-of-financial-management

2. Unraveling the difference between a balance sheet and income statement. URL: https://www.drivetrain.ai/post/balance-sheet-vs-income-statement

3. Understanding Liquidity Ratios: Types and Their Importance. URL: https://www.investopedia.com/terms/l/liquidityratios.asp

4. Cost-Benefit Analysis: How It's Used, Pros and Cons. URL: https://www.investopedia.com/terms/c/cost-benefitanalysis.asp

5. The Evolution of Cloud Accounting: Automation & Opportunities for Growth. URL: https://nerdssupport.com/evolution-accounting-cloud-growth/

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OPENING A BUSINESS IN A CRISIS PERIOD: STRATEGIES AND OPPORTUNITIES

The global economy often faces crises caused by a variety of factors. Among the main factors affecting the global and national economies are military conflicts that disrupt production chains and destroy economic ties between countries and political instability accompanied by changes in government, sanctions or the introduction of new regulations. Despite all these challenges, entrepreneurship remains one of the key drivers of economic development, and in times of instability, it becomes not just a means of securing one's own income, but also an important tool for creating jobs, supporting economic activity and introducing innovative solutions.

Many global companies were founded during periods of crisis, as non-standard conditions force entrepreneurs to search for new approaches and adapt to shifting market needs. Therefore, you need to prepare carefully before starting your own business. Entrepreneurs must identify a niche that will be relevant in specific economic conditions, assess their own resources, develop an effective business strategy, and find funding to implement their plans. An important factor is also the support of the state, which can provide consulting services, grants, develop educational programmes for entrepreneurs and offer favourable lending terms for small and medium-sized businesses [3].

In Ukraine, one of the most effective platforms for supporting entrepreneurs is Diia.Business. It is a service that provides access to a wide range of informational and consulting services. Here you can get the necessary market data, find out about financing opportunities, take educational courses and get help with legal and organisational issues [2].

However, even with such support, the success of any business begins with the right idea. Entrepreneurs should understand that not every idea will be viable in an environment of economic instability, so when choosing a business line, they should take into account both current market trends and possible changes in the future. For example, during the pandemic, the demand for online education services, delivery of food and essential goods, production of medical supplies and protective equipment has increased dramatically. Entrepreneurs should pay attention to those industries that demonstrate resilience to crisis phenomena. Among these promising areas are IT technologies (software development, web design, cybersecurity, business process automation, mobile application development), distance education (learning platforms, online courses, webinars, corporate training, specialised training), e-commerce (online stores, dropshipping, sales of digital goods and services), and the production of essential goods (food, hygiene products, pharmaceuticals, and environmental products). Special attention should be paid to social entrepreneurship - businesses aimed at solving social problems, such as supporting veterans or creating jobs for people with disabilities [3].

To determine the viability of a business idea, you need to conduct a detailed market analysis. It is important to study how much demand there is for a particular product or service, what competitive offers there are, and what are the strengths and weaknesses of a potential business. You should also pay attention to the availability of resources to launch the idea. Do you have sufficient start-up capital? Do you need a special certification or license? The answers to these questions will help you assess the realistic possibility of successful implementation of your plan.

After identifying a business idea, the next important step is to assess the available resources and capabilities, as any business project requires financial, intellectual, material and human resources.

Equally important is the availability of the necessary knowledge and skills to run a business. A business owner must be well versed in business management, understand

the principles of financial management and accounting, have a good grasp of marketing and sales, and be aware of the legal aspects of the company's activities.

At the start-up stage of a business, it is worth optimizing costs as much as possible, for example, by renting premises instead of buying them, using second-hand equipment or engaging external contractors through an outsourcing model. Effective management of material resources helps to minimise financial risks and increase business profitability.

The next important step is to develop a business plan, which is a strategic document for defining goals, development directions and necessary resources. It is the basis for attracting investment, obtaining loans or grants, and serves as a roadmap for effective business operations. The volatile economic situation or external environment should not be an obstacle to business development if you approach its creation and management with a clear strategic plan and awareness of all possible risks.

An important component is the proper management of available resources, which includes not only financial means, but also human capital, material resources and intellectual capabilities.

Thus, taking these factors into account and using business development tools significantly increases the chances of its successful launch and stable operation in the face of economic instability.

REFERENCES

1. Бізнес-ідеї у війну: які напрямки матимуть успіх до та після перемоги | Kyivstar Business Hub. *Kyivstar Business Hub*. URL: https://hub.kyivstar.ua/articles/biznes-ideyi-u-vijnu-yaki-napryamky-matymut-uspih-do-ta-pislya-peremogy (дата звернення: 09.04.2025).
2. Дія.Бізнес. *Дія.Бізнес Старт*. URL: https://business.diia.gov.ua/ (дата звернення: 09.04.2025).
3. Управління бізнесом під час війни. (2024). *БІЗНЕС ІНФОРМ 2024*. URL: https://www.business-inform.net/export_pdf/business-inform-2024-6_0-pages-332_339.pdf (дата звернення: 09.04.2025).

Сфера обслуговування: якість, тенденції та споживчі очікування

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LOGISTIC MANAGEMENT OF INTERNATIONAL PASSENGER TRANSPORTATION PARAMETERS BY FORECASTING

The development of international cooperation of Ukraine with European countries takes place in such areas as tourism and business, cultural, sports, scientific, technical and other kinds of international relations. According to the results of a research conducted in 2023 about 37% of Ukrainians travel abroad for tourism purposes, 29% travel to see relatives, 18% want to meet friends, 18% of respondents are for business trips [1]. The effective functioning of transport in modern conditions is aimed at meeting the urgent needs of millions of people. This contributes to the development of international cooperation and relations [2].

Some experience has been accumulated in the organization of international bus route system. In comparison with other types of transport, there are long-standing bus route traditions. For example, a bus route can be laid through small towns, making it accessible and convenient for family passengers and elderly people. Accompanying international bus passengers with qualified stewards and guides simplifies customs and border control procedures [3].

The full-scale war has changed the bus transportation market in Ukraine and created greater demand for it, primarily due to the suspension of air services. For example, in 2023 the number of bus passengers on BlaBlaCar in Ukraine increased by 86% compared to 2022. And in general, over the past 2.5 years, the Ukrainian bus market has grown at least tripled in monetary terms to about 7 billion (UAH).

Other factors also influence the increase in demand: the security factor, as people continue to leave front-line cities and villages; accessibility, as buses have a wider and more flexible list of destinations and routes than other modes of transport.

However, despite the turbulent period, seasonality remains an unchanged and it is a very important factor influencing the bus transportation market. As a result, passenger traffic in the high season can exceed the low or average indicators by more than twice [4].

The purpose of the study is to form an effective transport and logistics support for international passenger transportation based on passenger flow forecasting.

Three levels of seasonality in the bus market can be identified: high, medium and low [4]. The high season is the period of summer vacations, school holidays, public and other holidays such as Christmas, Easter, Independence Day, etc. The peak falls on June-August and December-January. The low season is the period from the second half of January to the end of February and from the second decade of September to mid-October. The dynamics of passenger flow also changes. Depending on the year, the difference between passenger flow in August and February can be 2 or even 2.5 times.

Since the beginning of the full-scale war, the following peak passenger flows have significantly decreased: students studying abroad; labor migrants who went en masse to seasonal work. This was also influenced by the impossibility of travel abroad for men of draft age, and the partial or complete restriction of migration of Ukrainians who have received shelter in other countries.

One of the key tools for adapting to seasonal fluctuations and predicting them is analytics. It helps to identify seasonal trends and predict peak periods. Based on this data, bus carriers can work on the regularity of the route network: reduce less popular destinations in a certain season and prepare the most capacious or additional transport for top routes.

The processes of seasonality in the work of motor transport company that performs international passenger transportation have been studied. A seasonal component was identified with significant increase in the number of passengers from

April to October (up to 140% in September and October) and declines up to 80% from November to April.

Transportation planning based on current forecast data and available operational information on passenger movement directions is proposed for more effective passenger traffic management. Current information helps to make decisions and form an effective transport and logistics transportation scheme.

It is sometimes difficult to adjust to seasonable fluctuations, taking into account the state of affairs, but strategic planning, flexibility and constant market analysis will help to stay afloat.

REFERENCES

1. Понад половина українців у 2023 р. їздили за кордон рейсовими автобусами – дослідження. *Interfax-Україна : інформаційне агенство*. Економіка. URL : https://interfax.com.ua/news/economic/958248.html

2. Кірічок, О. Г. (2013) Транспортна система України: напрями її інтеграції в транспортні структури Європи. *Вісник Національного університету водного господарства та природокористування*. Рівне. № 3 (63). с. 181–188.

3. Кірічок, О., Антонюк, В. & Шевченко, О. (2019) Роль і значення міжнародних автомобільних пасажирських перевезень у розвитку економіки країни. *Сучасні технології в машинобудуванні та транспорті*. Том 2. № 13. С. 68-75. URL : https://eforum.lntu.edu.ua/index.php/jurnal-mbf/article/view/89

4. Іцковська, О. (2024). Сезонні зміни на автобусному ринку: як підлаштуватись та менеджерити. *Сайт : Центр транспортних стратегій*. URL : https://cfts.org.ua/blogs/sezonni_zmini_na_avtobusnomu_rinku_yak_pidlashtuvatis_ta_menedzheriti_702

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THE HOSPITALITY INDUSTRY: SERVICE DIGITALISATION

Digitalisation is the process of saturating the physical environment with electronic and digital devices, systems and tools that enable electronic communication exchange between them. This process creates a cyber-physical space where the virtual and physical become integrated. This phenomenon has also affected the tourism and hospitality sector, leading to the emergence of new travel formats such as virtual tourism and 3D tours, as well as the intensive development of online platforms that meet the needs of the tourism industry. The Internet is becoming an essential tool for business development in the hospitality industry. Creating their own websites allows companies to offer unique offers, use low-cost advertising formats, and communicate electronically with consumers, partners, and tour operators [Кухарук, та ін., 2024]. A well-designed and user-friendly website not only increases business visibility, but also allows you to collect user data by customising the interface to suit their needs.

To ensure continuous and efficient communication with customers, hospitality companies are actively using chatbots. Integrating chatbots into platforms such as Facebook Messenger, Telegram, and Viber saves time and resources, reducing the workload of specialists. These technologies provide an individual approach to each consumer, are able to identify their needs, create personalised offers, and segment the customer base. This allows businesses to send out newsletters, keep records of customer relations and accept payments through integration with payment systems [Кирилюк, та ін., 2022].

Social networks play an important role in promoting the hospitality industry, providing businesses with the opportunity to quickly connect with potential customers,

reduce costs and increase profits. Social media is steadily growing in popularity among Internet users, now accounting for 53,6 per cent of the world's population. While websites remain important to users, activity is increasingly shifting to mobile browsers.

According to App Annie, only 8% of time spent on mobile devices by Android users is devoted to mobile web browsers, while 92% of time is spent using mobile apps.

The leading channel for promoting hotel and restaurant services in the conditions of digitalisation is the actual website of the establishment, and consumer feedback - representation in Internet booking systems (Booking.com, TripAdvisor, etc.) and the work of publishers of hospitality industry establishments in social networks, active maintenance of the page and creation of communication with a potential client [Кирилюк, та ін., 2022].

Having a cafe or restaurant with wi-fi and its own website has not made an impression for a long time. The technologies of promotion of the site in social networks are becoming more and more widespread, as by means of high-quality and bright pictures, advertising, promotions and drawings the number of potential clients is growing rapidly. And the application of QR code and cashless payment by means of pay pass technology is an integral attribute of a successful modern restaurant, which provides clients with speed and safety in search, selection and payment

Hotels around the world are actively implementing chatbot-based solutions, adding this convenient guest service channel to their offerings. Hotel chatbots and intelligent assistants can improve the guest experience.

Hotel chatbots have emerged as a powerful tool, helping hotel owners and managers meet growing demand for personalized services and seamless communication. The global chatbot market projected to reach $1,25 billion by 2025, and the hospitality industry is a key driver of chatbot adoption. Chatbots are no longer just a trend; they are an essential component of modern hotel management.

Moreover, guests show considerable interest in staying at hotels that offer chatbots as an additional support and service channel.

According to Statista, almost 80% of travellers worldwide are interested in having an intelligent automated assistant during their stay (Fig. 1) [Intellias, 2024]

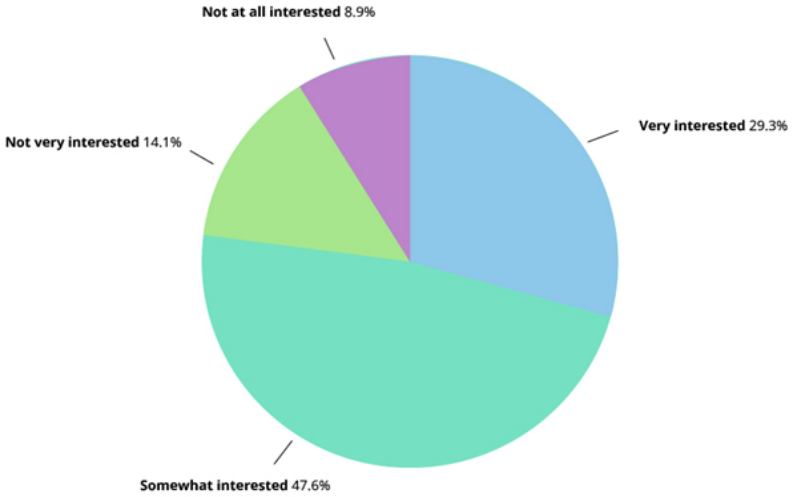

Figure 1. Share of hotel guests interested in a hotel supporting a chatbot or automated messaging

Active use of information technology in the hotel and restaurant business contributes to the growth of the number of visitors, increases the range of products and services, expands the scope of ways to conveniently perform tasks for employees, as well as, undoubtedly, the implementation of the latest unique solutions of enterprise management.

Digitalisation in tourism and hospitality plays an important role in the development of the industry by providing new opportunities for consumer interaction. Innovative technologies such as online booking, gamification and virtual reality are creating a new standard of service that meets the requirements of the modern consumer. This allows not only to meet the needs of customers, but also to significantly improve the efficiency of business processes in the industry, forming new trends in tourism and hospitality.

REFERENCE

1. Кирилюк І.М., Нещадим Л.М., Благополучна А.Г. (2022). Діджиталізация як основний фактор розвитку індустрії гостинності в умовах сучасних викликів. *Актуальні проблеми розвитку економіки*. Вип.18. С.217-131.

2. Кухарук К.С., Сухорукова А.Л. (2024). Матеріали II Міжнар. наук.-практ. конф. «Маркетингові та організаційні механізми повоєнного розвитку галузі гостинності та туризму України» (м. Харків, 26-27 листопада 2024 р.) Харків: НТУ «Харківський політехнічний інститут», 2024. Ч.2. 295 с. С.225-228.

3. Integrating Hotel Chatbots into Your Hospitality Business. (2024). *Intellias*. https://intellias.com/how-to-implement-hotel-chatbots/

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THE WORK OF THE HOTEL AND RESTAURANT ESTABLISHMENTS IN UKRAINE IN THE CONDITIONS OF WAR

The work of hotel and restaurant business is an important indicator of the country's economic stability. The war in Ukraine has dramatically changed the conditions of functioning of institutions in this area. Many businesses were forced to close or adapt to new realities, including a decline in the purchasing power of the population. Migration processes that changed customer flows and general demand for services were also significantly influenced. Security issues, restrictions on operations in the frontline regions and logistical difficulties were also important aspects [Безуглий та ін., 2024].

The war has significantly affected the number of existing establishments in the sphere of temporary accommodation and catering facilities. While in 2021 there were 69,7 thousand establishments in Ukraine, in 2022 this figure dropped to 57,7 thousand, which is explained by the mass closure of enterprises through hostilities, migration of the population and economic instability. However, in 2023 there was a partial recovery of the industry - the number of establishments increased to 67,3 thousand units as a

result of business adaptation to the conditions of war, opening new locations and support from international organizations - Fig. 1.

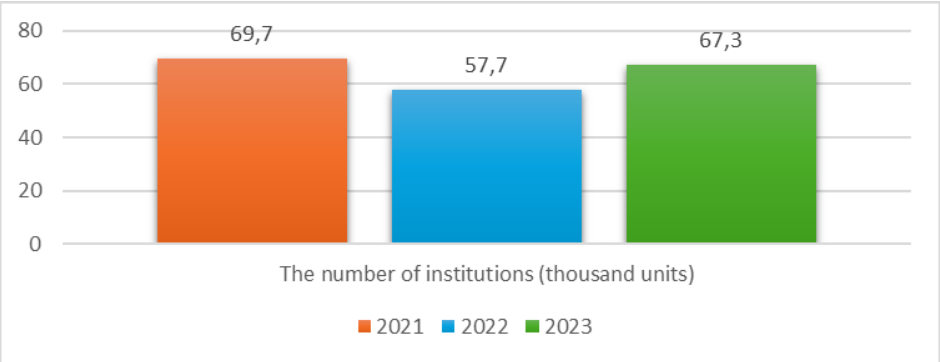

Figure1. Dynamics of the number of establishments of temporary placement and organization of food 2021-2023.

Source: [Державна служба статистики України, 2025]

At the same time, the structure of enterprises has changed: the share of legal entities in 2021 was 10,8%, and in 2023 it dropped to 8,3%, indicating a shift in business towards individual entrepreneurship, which provides greater mobility and financial flexibility. The share of individual entrepreneurs increased from 89,2% in 2021 to 91,7% in 2023, as large companies suffered greater losses due to the destruction of infrastructure and economic risks - Fig. 2.

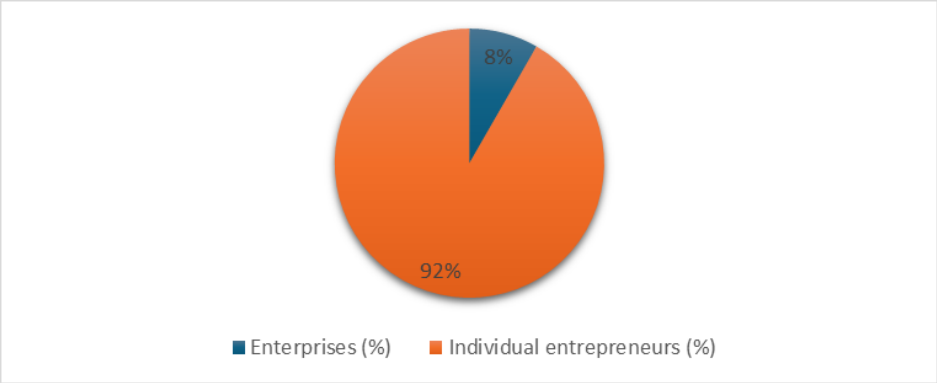

Figure 2. The structure of hotel and restaurant business in Ukraine in 2023

Source: [Державна служба статистики України, 2025]

Despite the negative trends of 2022, in 2023 there was a partial recovery in the temporary accommodation and catering sector. This is due to several factors. First, many Ukrainians returned home, which increased demand for services in the western and central regions. Secondly, international assistance has contributed to the

stabilization of the economy, which has eased the conditions for opening new institutions. Third, the role of volunteer initiatives and the support of displaced people has increased, which created new business models [Валінкевич та ін., 2024]. However, in 2023, the security situation remained unstable, limiting the ability to business recovery in some regions.

In 2024, hotel and restaurant business in Ukraine demonstrates a gradual recovery after a significant reduction in 2022. The main drivers of this process were the adaptation of enterprises to new economic realities, the growth of domestic tourism and the support of small businesses. Relatively safe regions continue to attract guests, which stimulates the development of hotel infrastructure. At the same time, restaurants and cafes are changing their operations, expanding delivery services, takeaway and special programs for displaced people and the military. Big business has suffered significant losses, while individual entrepreneurs have become more flexible and mobile, which is contributing to faster market adaptation.

Despite the positive trends, the industry remains sensitive to security risks that affect the investment attractiveness and enterprise stability. Some Ukrainian companies are expanding their operations to international markets, and foreign donors are supporting businesses through grant programs, which allows the sector to develop even in difficult conditions. In general, the hotel and restaurant business of Ukraine continues to adapt and find new opportunities, which allows us to predict further recovery in the coming years.

REFERENCES

1. Безуглий, В., Грушка, В., & Суматохіна, І. (2024). Специфіка функціонування туристичної галузі України в умовах воєнного стану. *Економіка та суспільство*, (63). https://doi.org/10.32782/2524-0072/2024-63-5

2. Валінкевич, Н., & Осіпчук, А. (2024). Економічний аналіз діяльності підприємств туристичної інфраструктури під час воєнного стану в Україні. *Економіка та суспільство*, (69). https://doi.org/10.32782/2524-0072/2024-69-153

3. Державна служба статистики України. (2025, 1 березня). https://www.ukrstat.gov.ua/

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PECULIARITIES OF TOURISM AND RECREATIONAL ACTIVITIES IN UKRAINE

The main requirements for the organization of recreational and tourist activities are set out in our legislation. Thus, the Law of Ukraine "On the Nature Reserve Fund of Ukraine" defines the possibilities and restrictions for the organization of recreation and tourism depending on the categories of territories and objects of the nature reserve fund (hereinafter referred to as the NRF). For example, tourism is prohibited in nature reserves and protected areas of national natural, biosphere reserves and regional landscape parks.

The Regulation on Recreational Activities within the Territories and Objects of the Nature Reserve Fund of Ukraine is a by-law designed to promote the proper organization of recreation and tourism within the NRF. A fee may be established for visiting the territories and objects of the NRF and providing services, in accordance with Article 47 of the Law of Ukraine "On the Nature Reserve Fund of Ukraine".

Therefore, to ensure the preservation of the values and integrity of natural and historical and cultural complexes and objects for future generations, the administration of the territories and objects of the NRF and other organizations and individuals responsible for the preservation of the territories and objects of the NRF or who are owners or users of land plots must act taking into account the legislation and the characteristics of specific natural or historical and cultural objects. That is, recreational and tourist use of the territories and objects of the NPF is possible provided that an appropriate system of management and economic measures is developed, taking into account the protection and use regime established for these territories and objects.

The basic directions of recreational and tourist activities within the territories and objects of the NPF are the following:

- Creation of conditions for carrying out these types of activities in compliance with the regime of the territories and objects of the NPF
- Organization and arrangement of information and tourist centers, ecological and educational trails, tourist routes, observation decks, recreational areas, campsites, rest camps
- Dissemination of information of advertising and informational content (publication in the media and on web pages of information about recreational resources and services
- Study, generalization and implementation of the best national and foreign experience and practices in organizing recreational and tourist activities
- Formation of a culture of recreation, recreation and tourism in nature among vacationers and local residents, a careful and humane attitude towards natural and cultural heritage.

The main types of recreational and tourist activities are organization of recreation, recreation, excursion activities, amateur and sports fishing, various types of tourism: children's, youth, family, for the elderly, for people with disabilities, cultural and educational, medical and health-improving, sports, religious, ecological (green), rural, underwater, mountain, adventure, automobile, amateur, etc.

Creating conditions for the development of recreation and tourism includes motivation and stimulation of all parties interested in the development of regulated recreation; planning of activities; organization of visitor services on the territory of the NRF; environmental control over the recreational and tourist activities of all entities on the territory of the NRF.

Minimization of the negative impact of vacationers on natural complexes and historical and cultural sites is carried out through development and implementation of special measures to preserve biological and landscape diversity, historical and cultural sites; implementation of environmental monitoring; restoration of disturbed natural and historical and cultural complexes and sites.

Creating conditions for the development of recreation within the territories and sites of the NRF and nearby, which rightfully belong to the main factors of development and regions, is impossible without an active position and interest of local (regional, district) authorities, territorial communities. Therefore, it is advisable to coordinate the strategy for the development of the territories and sites of the NRF with the plans of local authorities in the field of recreational activities and tourism.

Local governments, in cooperation with nature reserves, can develop training programs for the local population, provide preferential financing for joint projects in the field of recreation, and help form a market for agricultural products for subsequent sale to vacationers, thus providing the agricultural producer with a significant increase in local market.

Of course, for the effective development of recreation and tourism, extraordinary knowledge and skills are required. Some of the necessary knowledge can be obtained in educational institutions, or searched on the websites of international organizations, such as the World Tourism Organization or the International Union for Conservation of Nature.

REFERENCES

1. Serhiy Pavlov (2025) “Recreation”: https://wownature.in.ua/pro-nas/nasha-diialnist/rekreatsiia/

2. R. Kozhukhivska, O. Sakovska, G. Konieczny, P. Kolisnichenko (2024) “Peculiaritues of Tourism and Recreational Activities in Ukraine: Economic and Managerial Aspects”: https://link.springer.com/chapter/10.1007/978-3-031-48479-7_19

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TRANSFORMATION OF CONSUMPTION IN THE FIELD OF SERVICES IN THE CONDITIONS OF COMPREHENSIVE DIGITALIZATION

The service sector is experiencing unprecedented transformation driven by changing consumer expectations and technological advancements. As businesses navigate this evolving landscape, understanding and adapting to new consumer demands has become crucial for survival and growth. This paper examines the current state of consumer expectations and how businesses are responding to these changes.

Consumer expectations have shifted significantly in recent years, with several key trends emerging. There is a notable decrease in discretionary spending on material goods, while spending on experiences such as travel has increased, particularly among Gen X and Gen Z consumers. The integration of artificial intelligence and digital technologies has become central to service delivery, though consumers express growing skepticism about AI implementation. Businesses must balance technological advancement with maintaining human elements to preserve trust and authenticity.

Modern consumers demand personalized experiences while expressing concerns about data privacy. Companies are investing in advanced analytics and AI technologies to deliver tailored services while maintaining transparent data practices. Consumer demand for sustainable and ethically produced services has led to significant adaptations in business operations. To adapt to these evolving expectations, companies in the service sector are implementing several key strategies: *Digital Transformation, Customer Experience (CX) Management, Agile Service Design and Innovation, Omnichannel Integration, Sustainability and Social Responsibility.*

Several companies demonstrate successful adaptation to changing consumer demands. Netflix's evolution from DVD rental to streaming platform exemplifies successful digital transformation. Similarly, retailers like IKEA and Best Buy have successfully pivoted their business models to embrace e-commerce. Starbucks stands out for its customer-centric approach, continuously evolving its marketing strategies to maintain strong consumer connections worldwide.

Several case studies highlight how businesses are effectively adapting:

- Starbucks leveraged its mobile app and rewards program to personalize customer interactions, facilitate mobile ordering, and drive customer loyalty.
- Amazon, known for its customer-centric model, uses AI to optimize logistics, automate customer service, and make tailored recommendations.
- Telemedicine providers rapidly expanded during the COVID-19 pandemic by providing secure, accessible healthcare from home-meeting consumer expectations for convenience and safety.
- According to Netguru, many retail firms adopted hybrid business models post-pandemic, integrating e-commerce with physical stores through services like click-and-collect and virtual consultations.

Cloud computing, IoT, and big data analytics are becoming essential tools for service delivery and operational efficiency. These technologies enable businesses to better understand and respond to consumer needs while optimizing resource allocation. Future trends indicate continued focus on health and wellness, with increased interest in services promoting healthier lifestyles. The rise of the sober-curious movement among younger generations is reshaping service offerings in hospitality and entertainment sectors.

The ability to adapt to changing consumer expectations has become a critical determinant of success in the service sector. As customer demands evolve with advancements in technology and shifting social values, businesses must remain agile and responsive. Those that successfully integrate digital innovations, maintain transparency in their operations, and consistently prioritize customer experience while

also addressing concerns around data privacy and ethical practices are far more likely to thrive in today's highly competitive and dynamic environment.

REFERENCES

1. Digital Defynd. (2024). Business analysis case studies: Learning from global success stories. Digital Defynd IQ.

2. Johnson, K., & Smith, M. (2023). The adoption of digital technologies in business transformation: An empirical study. International Journal of Business Studies, 8(2), 112-128.

3. McKinsey & Company. (2023). The state of the US consumer: A look at spending trends and expectations. McKinsey & Company Consumer Packaged Goods Insights.

4. Netguru. (2023). How retail companies adapted their business models during COVID-19. Netguru Blog.

5. Number Analytics. (2024). Top trends in purchase behavior and market research: A comprehensive analysis. Number Analytics Blog.

6. PricewaterhouseCoopers. (2024). Consumer markets trends: Analysis and insights. PwC US Consumer Markets Library.

7. Qualtrics XM Institute. (2024). Global consumer trends: Understanding changing consumer behaviors and expectations. Qualtrics Blog.

8. U.S. Chamber of Commerce. (2023). Successful companies that reinvented their business: Case studies in adaptation and innovation. U.S. Chamber CO.

9. Zhang, Y., Sun, J., Yang, Z., & Wang, Y. (2022). Digital transformation in business operations: A comprehensive review and future research directions. PMC National Library of Medicine, 15(2), 45-67.

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ANALYSIS OF E2OPEN PLANNING SYSTEM IN THE FIELD OF TRANSPORT SERVICE

In the modern world the service sector plays an important role in economic development, occupying the largest sector in terms of volume and providing necessary and diverse services, contributing to economic development. In general sense, the service sector is a set of industries that include all types of commercial and non-

commercial services related to technical and information services that provide services to enterprises, organizations and individuals. Service sectors include finance and banking, education, the information industry, transport, etc. Each sector requires a detailed description as it plays an important role in the development of the economy. Among the numerous areas of the service sector the transport sector deserves special attention, as it directly affects the development of the economy, communication between regions and the quality of life of the population.

The transport service sector includes the provision of services aimed at satisfying the needs for movement, carrying out the transportation of goods and passengers. Transport services are the basis of logistics processes and contribute to the development of trade, industry and tourism.

Trends in transport development are aimed at increasing the efficiency and the quality of service provision while ensuring safety and convenience for users. Today, the development of transport sector is in the introduction of interconnected innovations. Supply planning software provides tools for managing the flow of goods and services. Supply chain management includes the movement and storage [2].

No less important trend is the introduction of information and innovative technologies along with the modernization of transport infrastructure. The use of analytical systems for real-time traffic monitoring, innovative designs, smart technologies and digital platforms allows to optimize transport flows, reduce the load on the infrastructure and create a safe and comfortable environment when organizing domestic and international transportation, satisfying the needs of all participants in the logistics process.

If we look at the logistics process in more detail, then we can see that, transport and logistics company plays an important role, the purpose of which is to provide the service of organizing the client transportation. Therefore, modern trends are aimed at improving the quality of customer service and ensuring convenience for consumers. Companies use modern systems and appropriate software to work with clients. One prominent example is the e2open planning system, which offers a connected supply

chain platform designed to optimize global trading enterprises. Figure 1 shows this. The e2open Planning Application Suite software is built on a single platform that allows users to plan and utilize multi-mode deliveries, optimizing delivery costs and ensuring quality customer service.

The e2open's connected logistics set helps organizations to plan and perform the movement of goods anywhere in the world with the ability to respond quickly to changes. With the help of e2open transport management, clients can simplify and optimize logistics with the help of one procurement, planning, implementation and regulation for all regimes and regions. Built for digital cooperation, TMS e2open has more than 40,000 logistics service providers and it allows the shippers to reduce the effort and speed of connection to new partners. Clients and their carriers benefit from sharing reliable information in real time in order to provide the highest levels of service.

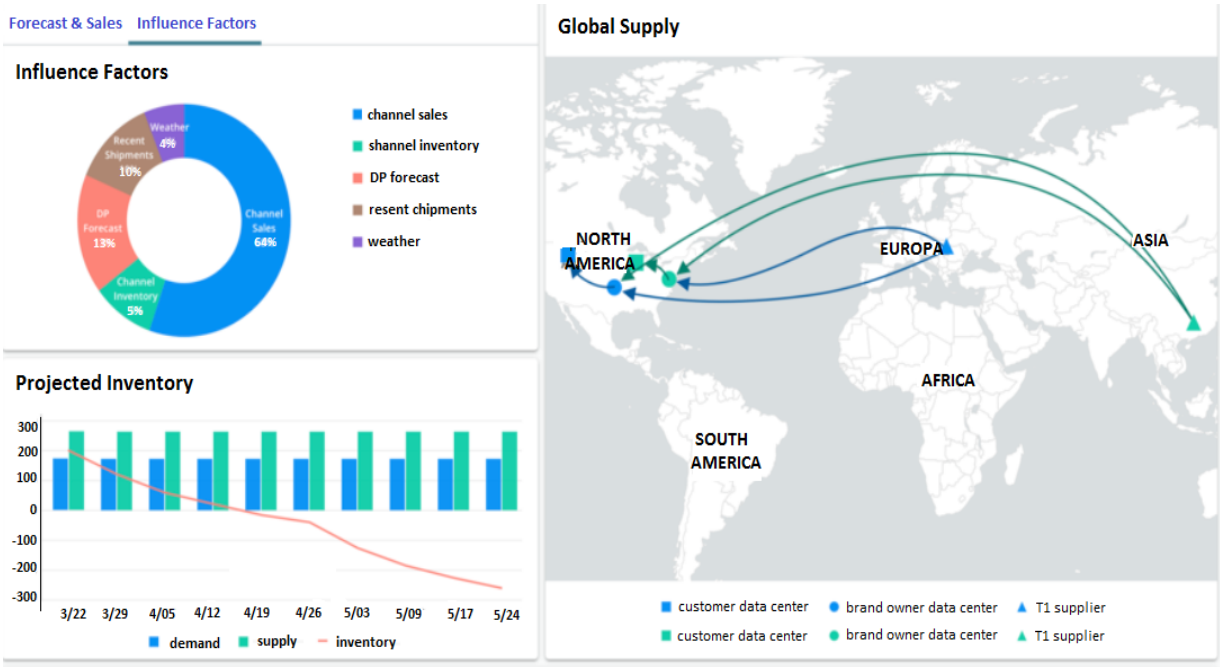

Figure 1. Dialog windo of e2open program [2]

Having analyzed the two main directions of modern trends development in the transport service sector, we can conclude that the main consumer expectations in the field of transport services are the modernization of infrastructure, the implementation

of innovative and information technology systems in order to organize safe and comfortable transportation with a high level of service.

REFERENCES

1. Біязь, А. І. & Брединський К. О. (2023). Забезпечення конкурентоспроможності транспортних послуг. *Гуманітарний і інноваційний ракурс професійної майстерності: пошуки молодих вчених.* 2023. Retrieved from: https://doi.org/10.36059/978-966-397-357-9-39.

2. Кошулько, О. (2025). *Найкраще програмне забезпечення для планування ланцюга поставок на основі ШІ на 2025 рік*. Retrieved from: https://gmdhsoftware.com/ua/supply-chain-planning-software/.

Інформаційні технології: цифрові трансформації та майбутнє галузі

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INFORMATION TECHNOLOGIES IN MODERN LOGISTICS SYSTEMS

In modern conditions of rapid growth in the volume of computer data processing, the role of information systems (IS) and software elements is growing as an important and relevant tool for analysis, planning and support for making commercial decisions in the organizations of various types of activity, including logistics systems (LS). The effective functioning of IS is impossible without the integration of modern information technologies (IT). Their application in logistics, which provides the most optimal management of transportation, distribution and warehousing operations at all stages of the chain from the producer to the consumer, is aimed at increasing the competitive advantages of business entities of different levels.

Information technologies in modern logistics are a set of methods, processes and automated software and hardware tools for the preparation, input, storage, processing, control and transmission of information, that specifies the needs of objects of such systems and supply chain links to ensure the movement of goods. That is, information resources are a key element of the resource potential of the enterprise and information itself is a key element of logistics operations [1].

In order to manage material flows, information systems in logistics can be created both at the micro level (individual enterprise), which, in turn, is divided into three groups: planning, dispositive (dispatching) and executive (operational), and at the macro level (region, country, group of countries). According to the logistics concept, certain groups are integrated into a single IS, within which vertical and horizontal integration are distinguished. Thus, the vertical one, using vertical

information flows (IF), combines the relationships between all three systems, and the horizontal one, in contrast, with the corresponding IF establishes a connection between separate sets of tasks of the same level [2].

The use of various information flows, circulating between the elements of the logistics system and the external environment for the organization of production and distribution of goods, leads to the formation of a single logistics information system (LIS). Automated systems for managing these processes LIS is a flexible structure of interconnected computing equipment, various reference books and necessary programming procedures (technologies) that ensure the solution of various functional tasks. Logistics information systems, belonging to different groups, must consist of orderly interdependent elements, and therefore, they are divided into functional subsystems and support subsystems.

The implementation of digital transformation opens up new approaches to supply chain management and distribution technologies, increasing the efficiency and competitiveness of companies, forecasting accuracy with reduced order processing time and reducing transaction costs [3].

This principle, therefore, focuses on the use of software for analyzing complex logistics processes, which includes such software products of various orientations and characteristics, as data analytics, artificial intelligence and cloud computing. Directly, a general graphical overview of goals and results is formed by a roadmap. The use of roadmap tools contributes to improving the coordination of activities and connections between elements by providing information about the project, in particular, regarding planning, tracking of operational tasks and processes.

The framework for developing a supply chain strategy is shown in Figure 1. The structure is presented in the form of an empty chart, which can be tuned according to individual needs. The finished example shown by Gartner presents a comprehensive idea of the supply chain strategy [4]. The top of the columns describes such actions as

data collection, transactions planning, forecasting, decision-making, cooperation, as well as design and modeling of products and processes.

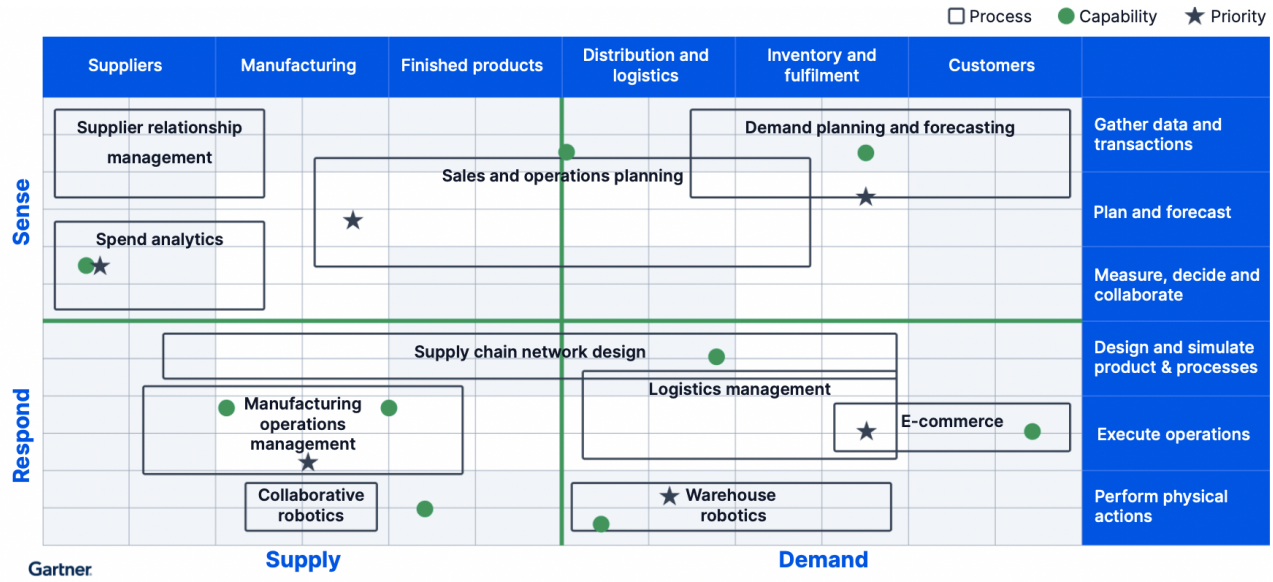

Figure 1. Diagram of the framework for developing supply chain strategy

Summarizing the conducted research, it can be concluded that the prospects for the application of information systems in the field of logistics are significant, as the latest technologies are being actively introduced into the computer functional area in order to increase the processing productivity, as well as the fast and automated management of information flows and resource volumes.

REFERENCES

1. Яценко Р. М., & Ніколаєв І. В. (2012). *Інформаційні системи в логістиці*. Харків: ХНЕУ. URL: https://duikt.edu.ua/uploads/l_1483_21999522.pdf.

2. Інформаційні технології в логістиці. *Освіта.ua*. URL: https://osvita.ua/vnz/reports/logika/25322/.

3. Марінов Є. А., & Лісений Є. В. (2024). Цифрова трансформація в логістиці. *Економіка та суспільство* (8 с., вип. № 66). Одеса: Видавничий дім «Гельветика».

4. Як цифрова трансформація працює для стратегії ланцюга поставок? *GMDH*. URL: https://gmdhsoftware.com/ua/how-does-digital-transformation-work-for-the-supply-chain-strategy/.

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AI-GENERATED CONTENT AND THE EROSION OF AUTHENTIC HUMAN VOICE

Faced with rapid digitalisation and the global spread of generative artificial intelligence (AI) models, machine-generated content is becoming an integral part of the communication environment. Since 2022, there has been a dramatic increase in the use of AI in media-oriented industries, raising concerns about the impact of such technologies on the authenticity of human speech, the creativity and expression of individuality (Floridi & Chiriatti, 2025).

AI-generated data covers a wide range of formats, from text and images to audio and video. It's a big deal because it can be used to create content that's pretty much anything you can think of. These systems are trained on huge data sets and are capable of imitating the structure and styles of human writing, visual and audiovisual expression (Bommasani et al., 2024). The sphere of application of AI content covers:

– journalism, where models automate the writing of news articles and sports reports (Linden, 2023);

– marketing, with personalised email campaigns and advertising;

– education, where training materials and test assignments are created;

– social media, where AI is used to generate posts, descriptions and even comments.

The main reasons why AI is so handy are that it can process info really fast, it is scalable, it cuts down on content production costs, and it can personalise stuff. A study by McKinsey (2023) found that using generative AI in marketing and customer service can increase productivity by 40–60%. In particular, algorithms can adapt texts to the

target audience by analysing user behaviour patterns and preferences (Chowdhury et al., 2022).

As part of platform optimisation, systems such as ChatGPT are able to create SEO-optimised articles and video scripts in seconds, minimising human input. This leads to a huge increase in the volume of content produced, but at the same time, it leads to standardisation and a loss of unique character. This is a big deal because it could make it harder for us to trust what we read. The Max Planck Institute study (2024) found that 68% of participants could not tell the difference between texts created by GPT-4 and texts written by journalists, with 71% noting a 'lack of a living voice and authorial stance' (Schulz et al., 2024). The result is style homogenisation and reduced expressiveness. According to WitGroup AI Lab (2025), in 79% of cases, AI-generated content was perceived as 'emotionally neutral,' even when the topic involved subjective judgement (Whitmore & Lang, 2025). This makes people less likely to trust messages, messing with how real they seem and weakening cultural and linguistic diversity in public spaces.

Authentic voice is not merely the presence of an author, but an expression of individual experience, emotional context, and cultural identity. Unlike algorithms, human speech has non-verbal cues, quick changes in meaning, and value judgements. As the Centre for Digital Communication (2025) points out, these are the things that help people identify the speaker as 'real' and build empathy (Delacroix et al., 2025). The excessive use of AI in the creative sphere leads to homogenisation of expression, the fading of individual differences, and a decreasing in the reader's cognitive engagement. The MIT Media Lab report (2024) emphasises that regular consumption of AI content leads to a decline in users' ability to distinguish between personal opinions and generalised formulas (Yang & Cortez, 2024). Even more, algorithms are trained on generalised data, excluding marginalised narratives and thus narrowing the range of cultural voices represented (Adebayo et al., 2024). AI content challenges the boundaries of intellectual property. Who owns the material created – the system, the user or the company? According to a study by the EU Digital Ethics Consortium

(2025), 82% of legal experts believe that mandatory labelling of machine-generated content is necessary to protect copyright and prevent source substitution (Keller & Ivanov, 2025). There are also questions about manipulation and trust – when the line between real and generated is blurred, society loses its bearings and becomes vulnerable to misinformation.

To retain individual expression in an environment dominated by generative algorithms, it is necessary to introduce hybrid authorship models, where AI serves as a tool rather than an independent author. The Stanford HAI report (2025) emphasises that the most valuable models are those where humans edit, reinterpret and adapt AI-generated text to a specific context (Nguyen & Kaur, 2025). This allows creative freedom and emotional colouring to be preserved while utilising the technical productivity of AI. In addition, it is essential to develop media literacy as a key competence for the 21st century. Research by the Digital Society Lab (2024) has found that training in AI content recognition increases critical awareness by a factor of 2.3 (Olsen et al., 2024). At the policy level, mechanisms for transparency and verification of content origin are becoming relevant. In 2025, the European Commission introduced a mandatory requirement for digital platforms to label AI-generated material under the EU AI Act (2025). Such actions help restore user trust and prevent manipulation. Platforms like LinkedIn and Medium are already incorporating automatic ‘Generated by AI’ notifications into published content. Future communication requires a rethinking of the role of the author: from ‘creator from scratch’ to ‘curator of meaning,’ capable of adapting machine output to the socio-cultural context. As researchers from the University of Oxford (2024) emphasise, in the new paradigm, humans become facilitators, guardians of value depth and authentic voices (Bennett & Rizwan, 2024). This demands not only technical literacy from authors, but also ethical responsibility for what and how they convey to their audience.

To sum up, actively bringing AI into communication makes content production more efficient, but there is a risk of losing that authentic human voice. Standardising how we express ourselves and losing emotional and cultural depth can make

communication less rich and trust weaker. Authenticity can be preserved through the development of hybrid models of authorship, increased media literacy, and regulatory frameworks. In the new world, people are not just creators, but curators of meaning – bearers of values and guardians of authenticity.

REFERENCES

1. Adebayo, J., Nguyen, L. and Rahman, S., 2024. *Algorithmic Bias and Cultural Homogenization in Generative Models*. MIT Press. Available at: https://mitpress.mit.edu [Accessed 30 Apr. 2025].
2. Bennett, M. and Rizwan, A., 2024. *Human Creativity in the Age of Machines: A Role Reimagined*. University of Oxford Digital Humanities Working Paper Series, No. 17.
3. Bommasani, R., Hudson, D.A., Adeli, E., et al., 2024. *On the Opportunities and Risks of Foundation Models*. Stanford Center for Research on Foundation Models. Available at: https://crfm.stanford.edu [Accessed 30 Apr. 2025].
4. Centre for Digital Communication, 2025. *Authenticity in AI-mediated Discourse: A Multinational Survey*. Geneva: CDC Research Briefs.
5. Chowdhury, G., Dang, H. and Patel, R., 2022. *AI in Content Personalization: A Systematic Review*. *Information Processing & Management*, 59(5), pp.1–15.
6. Delacroix, S., Müller, H. and Renner, P., 2025. *Perceived Authenticity in AI-mediated Communication*. Centre for Digital Communication. Available at: https://cdc-research.org [Accessed 30 Apr. 2025].
7. EU AI Act, 2025. *Regulation (EU) 2025/1124 of the European Parliament and of the Council on Artificial Intelligence*. Official Journal of the European Union. Available at: https://eur-lex.europa.eu [Accessed 30 Apr. 2025].
8. Floridi, L. and Chiriatti, M., 2025. *GPT-3: Its Nature, Scope, Limits, and Consequences*. *Minds and Machines*, 30, pp.681–694.
9. Keller, F. and Ivanov, T., 2025. *Ethical Frameworks for AI Content Disclosure*. EU Digital Ethics Consortium White Paper. Brussels: European Commission.
10. Nguyen, T. and Kaur, R., 2025. *Human-in-the-Loop Content Generation: Balancing Efficiency and Expression*. Stanford HAI Policy Reports, Issue 3.
11. Olsen, E., Marks, L. and Ferreira, J., 2024. *Media Literacy and AI: Preparing Consumers for Synthetic Content*. Digital Society Lab. Available at: https://digitalsocietyresearch.org [Accessed 30 Apr. 2025].
12. Schulz, M., Weber, C. and Tanaka, K., 2024. *Human Perception of Machine-Generated Narratives*. Max Planck Institute for Human Development. Available at: https://mpg.de/publications/ai-narratives [Accessed 30 Apr. 2025].
13. Weidinger, L., Mellor, J., Rauh, M. et al., 2022. *Taxonomy of Risks Posed by Language Models*. *Proceedings of the ACM Conference on Fairness, Accountability, and Transparency*, pp.214–229.
14. Whitmore, D. and Lang, J., 2025. *Emotional Flatness in AI Content: Empirical Assessment Across Domains*. WitGroup AI Lab Research Series, Report No. 9. Available at: https://witgroupagency.com [Accessed 30 Apr. 2025].
15. Yang, C. and Cortez, D., 2024. *Blurring the Line: AI, Opinion, and Public Perception*. MIT Media Lab Journal, 42(3), pp.134–149.
16. Zhou, Z., Li, F. and Benson, H., 2023. *Authenticity and Trust in AI-mediated Communication*. *Journal of AI and Society*, 38(2), pp.301–315.

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SIMULATING TRAFFIC DISRUPTION DURING ROAD WORKS

Urban road construction is vital to infrastructure, but often causes major traffic disruptions, which lead to poor traffic management, congestion and economic losses without accurate prediction tools. The study analyzes modern methods of modeling traffic flows in urban networks, affected by construction works in order to formulate recommendations for minimizing delays and optimizing traffic [1].

The objectives are to assess traffic changes under lane closures, to evaluate alternative routes and management strategies and to propose measures for alleviating congestion in construction zones.

The Cellular Automata (CA) model simulates a two-way, six-lane urban road network with roundabouts, featuring realistic vehicle behavior. Key components are lane change rules (overtaking and lane changes), intersection control via a priority system (no traffic signals) and congestion prevention to maintain network flow under high traffic. The network consists of 16 cells per lane, simulating vehicle movement. Key parameters are vehicle speed (0-60 km/h), traffic density (10-30 vehicles/km) and lane change probabilities (20% for overtaking, 15% for obstacle avoidance). Testing scenarios show that single-lane overlaps reduce average speed by 18-22%, while multi-lane overlaps (3 lanes) cause a 40% throughput decrease and increase intersection wait times to 8-10 minutes. Redirecting 20% from traffic to alternative routes reduces congestion by 35%, but raises load on adjacent streets by 15%. [2].

The TRANSIMS platform, developed by Los Alamos National Laboratory, integrates U.S. Census data to create synthetic populations and simulates their

movement through urban networks using algorithms like Dijkstra for route selection[3].

Dijkstra's algorithm optimized routes, reducing average travel time by 12-17%, can be compared to random route selection. Model validation against San Francisco data showed an 8-10% error. Real-time GPS data enabled dynamic adjustments, detecting anomalies (e.g., traffic accidents) and reconfiguring the model within 5-10 minutes. Using machine learning (Random Forest), traffic jams were predicted with 85% accuracy and with 30-60 minutes in advance.

Comparative analysis of management strategies are the following:

Strategy 1, which involves partial lane closures and driver information, reduces delays by 25% by distributing traffic between main and alternative routes. However, it risks overloading secondary roads during peak hours;

Strategy 2 is the night construction with full overlap which reduces construction time by 30% and increases costs by 20% due to payments for night shifts;

Strategy 3 is the adaptive traffic lights, which reduces congestion by 18% through dynamic signal adjustments and requires additional sensor infrastructure.

The average traffic speed without construction is 45 km/h with a single-lane closure drops to 37 km/h and with a multi-lane closure drops to 28 km/h. Waiting time at intersections increases from 2-3 minutes under standard conditions to 6-8 minutes during construction. Economic losses are significant with 15-20% increase in fuel consumption due to downtime and daily loss of 500-700 hours of driver time with 1 million city population.

The CA model is not accounted for psychological factors like aggressive driving. The TRANSIMS platform requires city-specific calibration due to variations in infrastructure. Mobile sensing technology has limited accuracy in areas with poor GPS coverage.

The CA model is a robust, scalable tool for simulating urban traffic disruptions due to road construction, allowing planners to develop optimized traffic management plans in advance. Integrating data from platforms like TRANSIMS and real-time

mobile sensing systems can lead to more accurate and adaptive traffic management solutions. Future research can be focused on combining these data sources with adaptive signal control and detour management techniques to enhance urban mobility modeling and planning accuracy.

REFERENCES

1. Balashova Yu. B., Balashov A. O. / AI-driven optimization for traffic safety: predicting and preventing collisions at road intersections using machine learning / International periodic scientific journal «Modern engineering and innovative technologies» ISSN 2567-5273, Issue №37, Part 2, February 2025, Karlsruhe, Germany, p. 91-99. DOI: 10.30890/2567-5273.2025-37-02-040 / URL: https://www.moderntechno.de/index.php/meit/issue/view/meit37-02

2.Shi, J., Hu, Y., Li, S., Li, Z., Zhang, X., & Mao, C. (2015). Simulation and analysis of road construction traffic flow in urban road networks. Advances in MechanicalEngineering,7(11),1–6. https://journals.sagepub.com/doi/10.1177/1687814015618176

3.Verge. (2001, January). Los Alamos National Laboratory's TRANSIMS project. Wired. https://www.wired.com/2001/01/verge-7

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ARTIFICIAL INTELLIGENCE (AI) IN SOFTWARE ENGINEERING

Introduction. The way we build software has changed fast and a lot. As technology advanced and software systems became more complex, the methods we use to develop them had to evolve too. We moved from rigid and linear approaches, like the waterfall model to more flexible and iterative methods such as Agile. These changes were driven by the need to make software development faster, more efficient, and more adaptable. Over time, practices like DevOps, continuous integration, and automated testing became standard, helping teams deliver better software more

reliably. However, despite all this progress, some challenges have stuck around, like coding errors, slow feedback loops, and inefficient use of resources.

This is where AI starts to play a big role. AI brings a fresh perspective to long-standing issues in software engineering. Its ability to spot patterns, make predictions, and automate complex tasks makes it a powerful tool for developers. Technologies like machine learning, natural language processing, and neural networks are already helping to streamline development workflows. AI-powered tools can automate repetitive tasks, assist in decision-making, and even catch problems before they happen. As a result, AI is not just making our processes smarter; it is also reshaping what it means to be a software engineer and what skills the job requires today.

In recent years, artificial intelligence has started playing a much bigger role in nearly every part of the software development process. One of the most noticeable changes is in code generation. Thanks to large language models (LLMs), we now have tools that can suggest or even write code with very little input from a developer. GitHub Copilot, for example, uses transformer-based models to offer smart, context-aware code suggestions, while DeepMind's AlphaCode has shown it can solve programming tasks by generating solutions that are close to what a human might write.

But, AI's role does not stop at writing code. It is also helping with bug detection and prevention. By training on past data, machine-learning models can now spot patterns that might indicate bugs, often before they become real problems. In testing, AI is making it possible to generate and prioritize test cases automatically, which saves both time and manual effort. Even when it comes to maintaining and improving code, AI is stepping in. It can recommend better ways to refactor code to boost performance and quality. Moreover, with predictive tools, teams can now get more accurate estimates of how long a feature might take to build or how many people they will need.

Alongside all this, explainable AI has become increasingly important. It focuses on making sure we understand how AI tools make decisions, which is critical in industries, like healthcare or finance, where transparency is essential. Meanwhile,

continuous learning systems are helping AI tools stay up to date with changing codebases, so they keep working well over time without falling behind.

Even with all these impressive advancements, there are still some important challenges to overcome. One big issue is that most AI tools today are built to solve very specific problems, like suggesting code or predicting bugs, but there is no unified system that connects all these tools into a smooth and end-to-end development process. As a result, these tools often work in isolation. For example, a code generation tool might not share useful insights with a bug prediction model, which can lead to a disjointed workflow for developers.

Another concern is trust. Even though explainable AI is helping make things more transparent, it is still not always easy for developers to fully understand or confidently rely on the recommendations made by AI tools. There is also the issue of data. Many AI models require large amounts of high-quality data to perform well, which makes them harder to apply in fields where data is limited or sensitive due to privacy concerns.

Ethical concerns are also becoming more important. AI systems can carry hidden biases, and there is a real risk that developers may start depending too heavily on automation, potentially weakening their own skills or producing biased or subpar code.

Nevertheless, the impact AI can have is undeniable. For example, GitHub Copilot version 1.7.4421 showed that developers using it completed tasks about 55% faster than those who did not. On top of that, the code produced passed test cases more often on the first try: — a clear sign that these tools can boost both speed and quality in development [1].

AI Applications in Software Engineering. AI has brought major changes to many areas of software development. By integrating AI-powered tools and techniques into workflows, software engineering has become more efficient, accurate, and adaptable. This section explores the key ways AI is being applied across the field, showing how it is reshaping traditional approaches and boosting overall productivity.

Selection Criteria for Tools and Datasets. The tools, datasets, and examples featured in this study were carefully selected based on the following criteria:

- Industry Relevance: Priority was given to tools and datasets that are widely adopted in real-world software development, such as GitHub Copilot and IBM's defect prediction systems.
- Recency: Only tools and datasets developed or actively maintained within the last five years were included to ensure the findings reflect the current state of the field.
- Accessibility: Preference was given to open-source resources and tools with clear and publicly available documentation to support reproducibility and transparency.
- Lifecycle Coverage: Selected examples span various stages of the software development lifecycle, including coding, testing, and maintenance, to provide a comprehensive view.
- Proven Impact: Tools and datasets with strong evidence of effectiveness, supported by industry use or academic research, were prioritized to focus on meaningful contributions.

Requirements Analysis: Natural Language Processing (NLP) for Requirements Gathering. Requirements gathering is one of the most critical steps in software development. It is where ideas and needs from stakeholders are translated into clear technical specifications. Traditionally, this has been a manual, time-consuming process, and one that is prone to miscommunication, missed details, and human error.

This is where AI, and specifically natural language processing (NLP), offers real value. NLP technologies are making it possible to automate and improve how requirements are collected and understood. These systems can scan large volumes of unstructured data, like emails, meeting notes, and user feedback, to extract key requirements. With the help of advanced language models, AI can identify both functional and non-functional requirements, spot unclear or conflicting statements, and

even suggest where further clarification is needed. This helps reduce the risk of misunderstandings that could turn into bigger problems later in the project.

Design and Architecture: Automated Design Pattern Recognition. Design patterns are proven and reusable solutions to common problems in software architecture. When used correctly, they help developers build systems that are both maintainable and scalable. Traditionally, recognizing when and where to apply design patterns has relied heavily on a developer's experience, but AI is starting to change that.

AI-powered tools can now assist in automatically identifying appropriate design patterns by analyzing project requirements and scanning the existing codebase. Using machine-learning models, these tools can examine source code and architectural diagrams to recommend patterns that improve efficiency, readability, and maintainability. This reduces the mental workload for developers, ensures greater consistency across the codebase, and speeds up architectural planning.

For instance, AI tools can detect where common patterns like Singleton, Observer, or Factory might be useful and suggest them accordingly. They can also recommend refactoring existing code to better match these patterns, leading to improved structure and performance. In addition to offering suggestions, AI systems can spot poor design choices or anti-patterns and guide teams toward better architectural solutions.

Conclusion. Artificial intelligence has become a practical and influential force in software engineering, reshaping key stages of the development lifecycle. From the early phases of requirements analysis to design, coding, testing, and maintenance, AI-powered tools are now embedded into workflows: — not as theoretical concepts, but as everyday utilities that solve real problems.

This paper has outlined how AI enhances engineering processes: by automating time-consuming tasks, improving accuracy, providing intelligent suggestions, and assisting with both strategic and routine decisions. Through examples such as natural language processing for requirements gathering and design pattern recognition for

architecture, we have seen how AI contributes not only to speed and productivity but also to software quality and maintainability.

In summary, AI has proven its value as a supportive layer within software engineering, helping teams build smarter, faster, and with greater insight. Its continued evolution promises deeper integration and broader impact, but its effectiveness will ultimately depend on how we, as engineers, design, adopt, and govern these technologies.

REFERENCES

1. Kalliamvakou, E. Research: Quantifying GitHub Copilot's Impact on Developer Productivity and Happiness. 2022. URL: https://github.blog/news-insights/research/research-quantifying-github-copilots-impact-on-developer-productivity-and-happiness/ (accessed on 11 November 2024).

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RÉFLEXIONS SUR LE RÔLE DE L'INTELLEGENCE ARTIFICIELLE DANS LE MONDE MODERNE

Introduction. Au 21e siècle, les technologies de l'information (TI) sont devenues un moteur du changement mondial, façonnant une nouvelle réalité numérique. La transformation numérique, qui comprend l'intelligence artificielle (IA), l'informatique en nuage, l'internet des objets (IoT), la blockchain et les technologies quantiques, modifie fondamentalement l'économie, la société et la vie quotidienne. Selon des rapports analytiques, le marché mondial des services informatiques atteindra 5 200 milliards de dollars en 2025, ce qui indique la croissance rapide du secteur [1].

Cependant, parallèlement aux opportunités, la transformation numérique entraîne des défis, tels que les cybermenaces, les dilemmes éthiques et l'inégalité d'accès à la technologie. Comme le note Klaus Schwab, «l'ère numérique ouvre de nouveaux horizons à l'humanité, mais exige en même temps de repenser notre place dans un monde où la technologie fait partie de la vie quotidienne » [4]. Ce document analyse les tendances actuelles de la transformation numérique, leurs causes et leurs conséquences, et développe des propositions pour un développement équilibré de l'industrie des technologies de l'information.

Énoncé du problème. La transformation numérique crée de nouvelles opportunités en matière d'automatisation, d'efficacité et d'innovation, mais elle engendre également un certain nombre de défis. Les principaux défis sont les suivants:

- **Cybersécurité.** En 2024, les pertes mondiales liées aux cyberattaques ont dépassé les 6 000 milliards de dollars, et la croissance du nombre d'appareils connectés (IoT) ne fait qu'augmenter la vulnérabilité des systèmes [2]. «Les cybermenaces modernes prennent de nouvelles formes, ce qui nous oblige à rechercher des solutions innovantes pour protéger l'espace numérique» [2].
- **Questions éthiques.** L'utilisation de l'IA, en particulier dans la prise de décision automatisée, soulève des inquiétudes quant à la partialité des algorithmes et à la perte de vie privée.
- **La fracture numérique.** Selon les Nations Unies, 37% de la population mondiale (environ 2,9 milliards de personnes) n'ont toujours pas accès à Internet, ce qui limite leur participation à l'économie numérique [3].

«L'exclusion numérique d'une grande partie de l'humanité est un obstacle à la création d'une société mondiale juste » [3].

- **Contrôle de la technologie.** L'automatisation excessive et le développement de l'IA peuvent conduire à une perte de contrôle sur la technologie, créant le risque d'une «capuche numérique» - surveillance totale et perte de liberté.

Comment assurer un développement harmonieux de l'industrie des technologies de l'information qui favorise le progrès sans menacer la sécurité, la vie privée et l'égalité sociale?

Causes et conséquences. Les raisons de la transformation numérique:

1. **Le progrès technologique.** Le développement de l'IA, de l'informatique quantique et des réseaux 5G/6G crée de nouvelles opportunités pour le traitement des données et la communication. Par exemple, en 2025, la 5G couvrira 60 % des utilisateurs mondiaux, et les premiers ordinateurs quantiques commerciaux sont déjà testés.

2. **Les facteurs économiques.** Les entreprises cherchent à optimiser leurs processus grâce à l'informatique dématérialisée et à l'automatisation, afin de réduire leurs coûts et d'accroître leur compétitivité.

3. **Le changement social.** La pandémie de COVID-19 a accéléré la numérisation de l'éducation, du travail et du commerce, faisant des services à distance la norme. «La crise sanitaire mondiale a incité à repenser le rôle de la technologie pour assurer la continuité des processus sociaux» [4].

Conséquences

- **Positif:** l'automatisation augmente la productivité, l'IdO contribue au développement des villes intelligentes et l'IA améliore les diagnostics en médecine. Par exemple, en 2024, les systèmes d'IA ont permis de détecter 30 % de cas de cancer supplémentaires à des stades précoces.
- **Négatifs:** les cybermenaces croissantes, les pertes d'emplois dues à l'automatisation (20 % des emplois devraient être remplacés par l'IA d'ici 2030) et les questions éthiques telles que l'utilisation de données sans le consentement de l'utilisateur.

Mes propositions de solution. Les mesures suivantes sont proposées pour surmonter ces difficultés:

1. **Renforcer la cybersécurité.** Développer des normes mondiales pour le cryptage et la protection des données, ainsi que mettre en œuvre l'IA pour la surveillance en temps réel des cybermenaces.

2. **Réglementation éthique de l'IA.** Création de comités internationaux chargés d'élaborer des principes éthiques pour l'utilisation de l'IA, y compris la transparence des algorithmes et la protection de la vie privée. « Ce n'est que grâce à un cadre éthique clair que nous pourrons garantir que l'IA servira la société et ne créera pas de nouveaux conflits » [1].

3. **Réduire la fracture numérique.** Investir dans l'infrastructure à large bande dans les pays en développement et dans des programmes d'éducation numérique pour les groupes vulnérables.

4. **Contrôle de l'automatisation.** Mise en œuvre de «mécanismes de freinage» dans les systèmes d'IA qui permettent aux humains d'intervenir dans les processus automatisés pour éviter de perdre le contrôle.

Mon avis. Je recommande personnellement d'utiliser l'intelligence artificielle et les nouvelles technologies. Tout d'abord, nous devons comprendre toutes les limites de cette utilisation, car les gens peuvent oublier la sécurité au nom de la science et de la nouveauté et recréer dans la vie des événements tirés du cinéma (Terminator, par exemple).

Il est important de noter que des structures supplémentaires sont nécessaires pour contrôler cela, pour garantir la sécurité des utilisateurs ordinaires. Par conséquent, je voudrais souligner qu'il est préférable d'attirer l'attention sur la sécurité plutôt que sur le développement du renseignement lui-même, car nous risquons d'oublier cette sécurité au milieu de ce développement.

Propositions et perspectives. Comment maîtriser les processus et éviter le «bouchon numérique»?

1. **Transparence des technologies.** Les entreprises d'IA et d'IdO doivent publier des rapports sur l'utilisation des données et des algorithmes. Par exemple, en 2025, l'UE a introduit la loi sur l'IA, qui exige la certification des systèmes d'IA à haut

risque [1]. «Ce document jette les bases de la création d'un environnement numérique où la technologie travaille au profit des humains, et non contre eux» [1].

2. **La décentralisation.** Utiliser la blockchain pour créer des systèmes décentralisés qui réduisent la dépendance vis-à-vis des grandes entreprises et protègent les données des utilisateurs.

3. **Contrôle public.** Mise en place d'organisations indépendantes chargées de surveiller l'introduction des nouvelles technologies et d'évaluer leur impact sur la société.

4. **Éducation et sensibilisation.** Améliorer la culture numérique pour que les gens puissent utiliser les technologies en toute connaissance de cause et protéger leurs droits.

Perspectives. L'avenir de l'industrie des TI est associé à l'intégration de l'informatique quantique, qui permettra de traiter les données des milliers de fois plus vite, et des technologies 6G, qui fourniront des communications ultrarapides avec un temps de latence inférieur à 1 ms. Parallèlement, le développement de la bio-informatique et des neuro-interfaces ouvre de nouveaux horizons pour la médecine et les communications. Toutefois, le principal défi consistera à trouver un équilibre entre l'innovation et la sécurité afin que les technologies soient au service de l'humanité et ne créent pas de nouvelles menaces.

Conclusions. La transformation numérique dans le secteur des technologies de l'information fait partie intégrante du monde moderne et ouvre des perspectives de progrès infinies. Toutefois, son succès dépend de la résolution des problèmes liés à la cybersécurité, à l'éthique et à l'égalité sociale. Les mesures proposées, telles que le renforcement de la réglementation, la décentralisation et l'éducation, permettront de contrôler le développement technologique et d'éviter les risques de panne numérique. L'avenir de l'industrie des technologies de l'information dépend des efforts conjoints des gouvernements, des entreprises et de la société pour créer un environnement numérique sûr et inclusif.

RÉFÉRENCES

1. Commission Européenne. (2025). Loi sur l'IA: Cadre réglementaire pour l'intelligence artificielle. [Disponible sur: https://digital-strategy.ec.europa.eu/fr/policies/regulatory-framework-ai]
2. Cybersecurity Ventures. (2024). Rapport sur les coûts des dommages causés par la cybercriminalité. [Disponible sur: https://cybersecurityventures.com/cybercrime-damage-costs-report/]
3. Nations Unies. (2024). Rapport sur la fracture numérique: Accès mondial à Internet. [Disponible sur: https://www.un.org/en/desa/digital-divide]
4. Schwab, K. (2016). La quatrième révolution industrielle. Forum Économique Mondial. [Disponible sur: https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab]

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EVOLUTION OF THE REACT LIBRARY: FROM ITS ORIGINS TO THE PRESENT DAY

Modern web development demands tools for fast, efficient interface creation with minimal errors. React is a library that revolutionized frontend development.

The emergence of React marked an important milestone in the development of web technologies due to its innovative approach to managing the user interface. Its key principles such as component architecture, the use of a virtual DOM and a declarative approach simplify the creation of interactive interfaces. It is necessary to describe how parts of the interface should look in each state of the application and React will update and render only those components that need to be changed after data modification. Declarative interfaces make the code more understandable and easier to work with.

React continuously evolves, introducing new features like hooks and server-side rendering, and meet modern development approaches. As an integral part of

JavaScript, the library has shaped web development, so let's explore its key milestones and updates.

React 0.x was released in 2013, introducing the component-based approach, virtual DOM and JSX for describing components. Versions React 15, React 16 and React 17 were released between 2016 and 2020. Major changes included the next steps: improved handling of text nodes and methods for comparing them in the DOM; a new Fiber architecture; the introduction of error boundaries for error handling; the creation of new hooks (useEffect, useContext, useReducer); grouping child components without adding unnecessary nodes; new APIs for event handling; updates to parts of the app using the new React versions.

React 18 was released in 2022. It introduced automatic batching of state updates for asynchronous operations such as promises, timeouts and fetch requests. Batching is the process of grouping multiple state update calls into a single render step, improving performance. Before React 18, batching also existed but worked automatically only for DOM event handlers. A new "strict effects" mode is added and its effects for mounted components are called twice (mount -> unmount -> mount). This ensures stable operation of components and correct operation of Fast Refresh. Asynchronous rendering is introduced to improve performance. A new API, useTransition, is added.

React 19 was released in 2024. New hooks such as useActionState, useFormStatus, and useOptimistic were introduced. To improve rendering efficiency and optimization of resources, support for server components was expanded. The new API use simplifies the processing of promises precisely in components. Ref is now passed into functional components as a prop. The Context API is updated to provide more efficient global state management. Additionally, support for document metadata, styles, and asynchronous scripts was added to improve SEO and performance. Page load times were further reduced by enhancing hydration and differentiation [1].

React, a popular development tool, continuously improves to meet developers' needs and web development trends. Each version enhances app performance with

backward compatibility. React 19 becomes more efficient, simplifying the creation of fast and interactive web applications.

REFERENCES

1. React. (n.d.). Versions. React. https://react.dev/versions

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THE BENEFITS OF GAMING

The topic is *The Benefits of Gaming*, with a focus on how video games can enhance our skills. This subject is particularly relevant in our era, as gaming has emerged as a major form of entertainment, drawing millions of people globally into immersive virtual worlds and interactive experiences. Video games provide a significant source of adventure and entertainment. Whether played on a console, computer, or mobile device, gaming has captivated audiences of all ages.

However, gaming is more than just a recreational activity. Far from being merely a source of entertainment, video games have proven to be an influential tool in personal development. There are three major positive effects of gaming. And it is necessary to look into possible bad influence of videogames and how to prevent it. This raises the broader issue of whether video games are truly beneficial and what specific positive impacts they offer.

The first point is that games offer engaging and stimulating activity. A variety of studies have explored the impact of gaming on problem-solving skills. One study,

published in the journal “Psychology of Popular Media Culture”, found that individuals who played video games regularly demonstrated better problem-solving abilities compared to non-gamers.

Unlike TV shows and movies, video games are interactive and demand focus on details and task management. Consider role-playing games (RPGs) like “Cyberpunk 2077” or “The Last of Us” feature a primary list of quest objectives to finish the game. In addition, there is a longer list of optional side objectives that help flesh out the game’s story and reward system [2].

Moreover, games can be an effective way to engage in learning. Video games cover nearly every subject imaginable. From the beginning developers recognized that video games could help to enhance skills in reading and mathematics. Today, there are games that explore subjects like world history, cooking, politics, chemistry, architecture, and many other areas you might not have encountered in school or daily life [4].

The second point is that games can increase brain matter. Extensive research has demonstrated that video games influence brain plasticity, the brain's ability to adapt and change in response to learning, by engaging attentional control and reward processing. The idea here is that the more you’re able to direct attention toward a certain task, the more stimulated you are by completing that task and then move on to more complicated tasks [3].

The most interesting research further suggests that video games have the potential to slow mental aging. A study conducted by researchers at the University of Iowa found that playing for just two hours a week can help slow cognitive decline associated with aging. Participants were assigned either a computerized crossword puzzle or a game called “Road Tour” over five to eight weeks. The study, which involved 681 people aged 50 and older, revealed that playing “Road Tour” for 10 hours helped to delay the decline of certain cognitive skills. In some cases, the slowdown was up to seven years [1].

Another example of the positive impact of the gameplay is improvement of focus and visuomotor abilities.

Paying close attention to visual and auditory cues is often necessary to accomplish certain tasks in a video game. Pediatric behavioral health specialist Michael Manos, PhD, explains, “When you’re watching a video game, you’ve got to pay attention to every little thing that comes into your visual field and react to it.” He adds, “Being able to visually contrast, being able to tell the difference between one thing and another, is also a skill that can be developed by playing video games.” [3]

It's also important to discuss the possible negative effects of gaming. The most vulnerable to the negative effects of games are undoubtedly children.

Some potential negative effects of gaming on children include:

1. Sleep disturbances: Late-night gaming can interfere with sleep schedules, impacting concentration, mood, and academic performance.
2. Social isolation: Spending too much time in virtual worlds may reduce real-life social interactions, potentially leading to feelings of isolation.
3. Exposure to inappropriate content: Some games contain violent or mature content that can be harmful for younger children and may impact their behavior or emotional development.
4. Addiction and time management issues: Excessive gaming can lead to addiction, making it difficult for children to balance time between games and other activities like school, sports, and social interactions.
5. Decreased physical activity: Spending too much time gaming can reduce physical activity, leading to health issues like obesity and poor posture [5].

With guidance and time limits, parents can help mitigate these effects and encourage a balanced approach to gaming. To foster a positive experience, parents might consider the following tips:

1. Set limits: Establish clear time limits for gaming and encourage breaks and other activities to maintain balance.

2. Encourage social interaction: Support multiplayer games that promote collaboration and communication, enhancing social and problem-solving skills.

3. Monitor content: Ensure the games your child plays are age-appropriate and promote positive values.

4. Engage in discussions: Talk to your child about the games they play and the skills they're developing, addressing any concerns openly.

By following these tips, parents can ensure gaming remains a positive, enriching activity for their children.

In conclusion, video games are far more than just a source of entertainment. They can significantly enhance skills such as problem-solving, focus, and cognitive flexibility. From improving cognitive abilities to fostering learning in diverse subjects, gaming offers numerous benefits when approached in a balanced way.

However, it's important to be mindful of the potential negative effects, especially for children. With the right guidance and boundaries, parents can ensure that gaming becomes a constructive and positive activity that contributes to their child's development.

REFERENCES

1. Are Video Games Good for You?. *FunTech Blog*. URL: https://funtech.co.uk/latest/are-video-games-good-for-you (date of access: 05.12.2024).

2. boss loop. The Benefits of Gaming: How Video Games Can Improve Problem-Solving Skills. *Medium*. URL: https://medium.com/@singharmaandeep380/the-benefits-of-gaming-how-video-games-can-improve-problem-solving-skills-dcaa4f34791f (date of access: 05.12.2024).

3. Clinic C. Are Video Games Good for You?. *Cleveland Clinic*. URL: https://health.clevelandclinic.org/are-video-games-good-for-you (date of access: 05.12.2024).

4. cms_app. Benefits of Video Games For Kids & Adults. *GEICO Living*. URL: https://living.geico.com/home/technology/9-reasons-to-give-video-games-a-try/ (date of access: 05.12.2024).

5. Kids and video games: the good and the bad : Inside Children's Blog. *Inside Children's Blog*. URL: https://www.akronchildrens.org/inside/2023/02/13/kids-and-video-games-the-good-and-the-bad/ (date of access: 05.12.2024).

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CREATING IMMERSIVE EXPERIENCES WITH SOUND AND VISUAL EFFECTS IN VIDEO GAMES

The gaming industry has rapidly evolved, with more games being created each day, offering an expanding array of interactive experiences. As the industry grows, developers strive to create memorable and immersive games that players will revisit repeatedly. Immersion, one of the most compelling aspects of video games, plays a key role in keeping players engaged and invested in the game world. When a game is immersive, players do not merely control a character or watch a story unfold, they feel as though they are a part of the game itself. This connection deepens the emotional impact of gameplay, drawing players into the story and the world they inhabit. Among many factors contributing to this immersive experience, sound design, visual effects and animations are some of the most crucial elements. These factors not only enhance realism but also help to create a richer and more emotionally engaging experience. These theses will explore the role of sound design, visual effects, and animation in creating immersive game worlds, as well as the tools that developers use to craft these experiences.

Sound design plays a crucial role in video games, serving as a fundamental element that shapes the overall mood, atmosphere, and emotional experience of the player. Through the careful use of audio, developers can convey feelings such as suspense, fear, joy, or relief, and, in doing so, help players to connect more deeply with the game world. Sound design in games can be divided into several categories, each contributing to the atmosphere in different ways.

One of the primary types of sound used in games is ambient sound. These are background noises that help to establish the environment, such as the sounds of wind, birds, or distant voices. These sounds make the virtual world feel alive and they can vary significantly depending on the setting, whether it's a bustling city or a quiet forest. In addition to ambient sounds, character sounds play a significant role in making characters feel more real. These sounds include footsteps, voice acting and the noises associated with actions such as running, fighting or reloading a weapon. By carefully recording and incorporating these sounds, developers can give life to characters, enhancing their believability. Furthermore, adaptive audio, which changes based on in-game events, can elevate the tension or excitement in a scene. For instance, music in a battle scene may become more intense to reflect the action, or the volume may drop during moments of quiet to allow players to focus on their surroundings [2].

Two games that exemplify the importance of sound design are *Resident Evil 2* and *The Last of Us*. In *Resident Evil 2* the ambient sounds such as distant footsteps, creaking floors, and the constant hum of rain in an old police station contribute to a feeling of unease. The game also makes effective use of adaptive audio during the moments of high tension, such as being pursued by a zombie, the music becomes more frantic and signals imminent danger. In *The Last of Us* character sounds such as footsteps on different surfaces and the grunts of characters during combat add authenticity to the gameplay, while the adaptive music shifts with the emotional tone of the scene, amplifying the player's connection to the characters' struggles and triumphs.

Another essential aspect of creating immersive game experiences is the use of visual effects (VFX), which significantly enhance the realism and aesthetic appeal of the game world. Visual effects can range from simple effects such as changing lighting to complex simulations like fire or smoke. One key technique used in creating VFX is particle systems, which simulate elements such as fire, rain, smoke, or dust. These systems contribute to a game's atmosphere by adding dynamic and

interactive elements that respond to the player's actions and the game's environment [5].

Lighting and shadows are also essential to creating mood and depth in a game. Dynamic lighting allows developers to manipulate light and shadow in real-time, which can dramatically alter the tone of a scene. For example, lighting may be bright and hopeful during moments of peace but dark and oppressive during tense encounters. Shaders and reflections add another layer of realism to a game, particularly in environments with reflective surfaces such as water or metal. These techniques help surfaces look more lifelike, enhancing the player's sense of presence in the world.

A prime example of the use of VFX is *Red Dead Redemption 2*, which is known for its stunningly realistic environmental effects. The game's dynamic weather systems, where rain, snow and fog seamlessly alter the environment, contribute significantly to the immersive experience. Similarly, *Cyberpunk 2077* utilizes neon lighting and reflective surfaces to capture the essence of a futuristic city, allowing the player to feel as though they are truly in the heart of a bustling cyberpunk metropolis [1].

The importance of animations in video game development lies in their ability to bring characters and environments to life, enhancing realism and player immersion. They allow characters to move naturally, interact with their surroundings, and respond to environmental changes in a believable manner. There are two primary types of animation used in game development: motion capture (mocap) and physics-based animations.

To elaborate further, motion capture technology plays a significant role in creating lifelike character animations by recording the movements of real-life actors and transferring them to in-game models. This technology makes animations more lifelike, as the movements of characters appear natural and fluid. In addition to mocap, physics-based animations simulate how characters interact with the environment. For example, ragdoll physics are used to create realistic reactions when characters are knocked over or shot. Similarly, environmental animations such as the movement of

water, grass, or trees in response to wind or weather conditions help to make the game world feel dynamic and responsive [6].

A good example of this are games such as Detroit: Become Human and Red Dead Redemption 2, which demonstrate the importance of animations in immersion. In Detroit: Become Human, motion capture is used to create realistic character interactions, making the characters' emotions and gestures feel authentic. In Red Dead Redemption 2, the attention to detail in character animations, such as the way the protagonist, Arthur Morgan, moves through snow or interacts with the environment adds depth to the experience and reinforces the game's realistic portrayal of a living, breathing world.

Finally, the creation of these immersive elements in games depends on a wide range of tools and technologies that enable developers to bring their vision to life. Two of the most widely used game engines are Unreal Engine and Unity. These engines provide powerful tools for creating both sound and visual effects, allowing developers to design realistic and dynamic environments [3]. Audio software such as FMOD and Wwise are used to layer complex audio tracks and create adaptive sound systems [4]. For visual effects, tools like Houdini allow developers to create advanced simulations for elements like fire, smoke, and weather. These technologies enable game developers to implement quickly the sounds, visuals, and animations that make a game world feel alive and engaging.

So, to summarize sound design, visual effects and animations are essential in creating immersive video game experiences. Sound helps to set the mood and atmosphere, visual effects bring the game world to life, and animations make characters and actions feel authentic. Together, these elements enhance the player's emotional connection to the game and make it more engaging and memorable. As the gaming industry continues to evolve, technological advancements in these areas will allow for even more convincing and immersive virtual worlds, where players can experience emotions and stories like never before. By utilizing the right tools and

techniques, developers can create experiences that captivate players and leave a lasting impact on the gaming community.

REFERENCES

1. Cyberpunk 2077 on Steam. *Welcome to Steam*. URL: https://store.steampowered.com/app/1091500/?snr=1_5_9__205 (date of access: 05.12.2024).
2. Importance of Sound Design in Games: A Detailed Guide. *Juego Studio*. URL: https://www.juegostudio.com/blog/sound-design-in-games (date of access: 05.12.2024).
3. Unity vs Unreal Engine: Key Similarities and Differences. *Fgfactory Australia*. URL: https://fgfactory.com.au/resources/unity-vs-unreal-engine-comparison#:~:text=Unity%20and%20Unreal%20Engine%20are,when%20powerful%20visuals%20are%20needed. (date of access: 05.12.2024).
4. Unleashing Immersive Audio Experiences with FMOD and Wwise: Essential Tools for Game Development and Interactive Media. *Curate Partners*. URL: https://curatepartners.com/blogs/skills-tools-platforms/unleashing-immersive-audio-experiences-with-fmod-and-wwise-essential-tools-for-game-development-and-interactive-media/ (date of access: 05.12.2024).
5. VFX and its importance in video games | Dreams Quest. *Dreams Quest*. URL: https://dreams.quest/post/vfx-and-its-importance-in-video-games#:~:text=VFXs%20are%20quite%20essential%20in,on%20them,%20sometimes%20even%20more. (date of access: 05.12.2024).
6. What is Game Animation? A Comprehensive Overview - Pixune. *Pixune*. URL: https://pixune.com/blog/what-is-game-animation/ (date of access: 05.12.2024).

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE LABOUR MARKET: RISKS AND OPPORTUNITIES

The development of artificial intelligence is having a significant impact on the modern labour market, transforming both individual industries and the economy as a whole. Over the past decades, AI technologies, including machine learning, robotics and process automation, have penetrated all areas of life, from manufacturing and

finance to medicine and education. This creates new business opportunities, increases production efficiency, improves the quality of services and reduces costs. However, along with its benefits, the introduction of AI also brings a number of challenges, especially in the context of the labour market. Thus, researching the impact of AI on the labour market is relevant and necessary to understand how technologies are changing the nature of work, what opportunities and risks they bring, and what measures are needed to minimise the negative consequences and maximise the positive effects of AI. This will allow developing strategies to adapt the labour market to new conditions, ensure fair redistribution of benefits and maintain socio-economic stability.

The AI market is developing rapidly and is already one of the most dynamic in the world. From 2020 to 2030, the AI market is expected to grow significantly, driven by the introduction of this technology in various sectors, including healthcare, finance, manufacturing, transport, education, and others. According to Statista [Statista, 2024], the global AI market was estimated at $93.27 billion in 2020. The situation has now changed after the elections and new strategies of the new president in the United States.

In advanced economies, AI could affect around 60% of jobs. In more than half of these jobs, the introduction of AI will have a positive impact on productivity. In the other half, AI could replace key tasks currently performed by humans, which could reduce demand for labour, leading to lower wages and fewer hires.

The changes brought about by the introduction of AI are having a significant impact on smart businesses, regional economies, entrepreneurship and business culture, and the global economy as a whole. Intelligent business, which is based on the use of the latest technologies and data, is particularly benefiting from the integration of AI. It allows businesses to automate routine tasks, increase efficiency and make more informed decisions based on the analysis of large amounts of data.

AI is also changing the approach to entrepreneurship and business culture. On the one hand, new technologies create opportunities for start-ups and innovative businesses that can quickly adapt to changes and develop new solutions. On the other hand, businesses are facing challenges related to the need to integrate AI into business

processes and adapt to rapid technological change. Business culture is also being transformed by AI [Honcharenko, 2024].

AI is already having a significant impact on the labour market, transforming industries and changing the way we work. While there are significant benefits associated with automation and process optimisation, the introduction of AI also comes with numerous challenges that require attention from governments, businesses and society. AI offers significant opportunities to transform the labour market, but these opportunities are accompanied by numerous challenges. Job replacement, income inequality, the need for new skills, ethical issues, changes in organisational culture, and regulatory barriers are among the main issues that need to be addressed.

In order to maximise the potential of AI, it is necessary to develop comprehensive strategies aimed at re-profiling employees, ensuring equal access to educational resources, creating ethical standards and adapting legislation. Only then will the introduction of AI ensure a balanced and sustainable development of the labour market [Kostyk, та ін., 2024]. While AI can replace certain job functions, it also offers significant opportunities for job creation. Developing, implementing and maintaining AI technologies requires skilled professionals. New roles such as artificial intelligence specialists, data analysts, and machine learning engineers are emerging, providing job opportunities for people with the right skill set. AI doesn't replace people, it empowers them. Using AI technologies, humans can work side by side with intelligent systems, combining their unique problem-solving, creativity and empathy skills with the efficiency and computing power of AI. This collaboration can lead to more efficient and effective outcomes.

There is no doubt that AI will have an impact on the labour market, with both opportunities and challenges. While job loss is still a concern, there are opportunities for growth and innovation through new roles, productivity gains and human-AI collaboration. People and organisations need to adapt, upskill and use ethical practices when working with AI. We can build a future in which humans and AI collaborate to

advance technology and improve the quality of work and life by embracing AI technologies and developing purely human talent.

REFERENCE

1. Гончаренко К. (2024). Штучний інтелект і ринок праці: основні виклики та можливості. URL: https://budni.robota.ua/career/shtuchniy-intelekt-ta-rinok-pratsi-osnovni-viklyki-ta-mozhlivosti (дата звернення: 25.08.2024).
2. Kostyk, Y., & Tsymbal, K. (2024). Вплив штучного інтелекту на ринок праці. *Economics and Region*, (3(94), 6–12. https://doi.org/10.26906/EiR.2024.3(94).3477
3. Statista. (2024). Artificial intelligence (AI) market size worldwide from 2020 to 2030. Available at: https://www.statista.com/forecasts/1474143/global-ai-market-size (accessed August 25, 2024).

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ACCESSIBLE DESIGN: PRINCIPLES, CHALLENGES, AND BEST PRACTICES

Accessibility refers to the practice of designing products and experiences that are usable by all individuals, regardless of their physical or cognitive abilities (World Wide Web Consortium [W3C], 2018). It is fundamentally about fostering inclusion, ensuring that no individual is excluded from utilizing digital tools or services. Accessibility goes beyond mere legal compliance; it seeks to uphold the principle that digital experiences should be available to all.

Promoting accessibility within design practices supports broader societal inclusion. By ensuring that information is accessible and interactions are equitable, designers create environments where all individuals can participate fully (Shinohara & Wobbrock, 2016). Moreover, many features now regarded as standard, such as voice assistants, captioning, and touchscreen interfaces, were initially conceived as

accessibility solutions. This highlights that accessible design ultimately benefits a wider audience.

To design effectively for accessibility, it is essential to understand the diversity of disabilities, which are generally categorized into four main groups:

1) Cognitive disabilities which nclude difficulties related to memory, learning, reading, or attention.

2) Motor disabilities which ncompass challenges in using input devices such as a mouse, keyboard, or touchscreen.

3) Hearing disabilities which affect individuals who are deaf or hard of hearing.

4) Visual disabilities that range from low vision to complete blindness.

Additionally, disabilities may be permanent, temporary, or situational, further emphasizing that accessible design has far-reaching benefits.

Effective accessibility is guided by four foundational principles, collectively referred to as POUR (W3C, 2018):

- Perceivable. Information must be presented in ways that users can perceive, whether through sight, sound, or touch.
- Operable. Interfaces must be navigable and usable for all users, including those relying on keyboard navigation or alternative input devices.
- Understandable. Content must be clear, predictable, and easy to comprehend, using straightforward language and minimizing complex interactions.
- Robust. Content must be compatible with both current and future technologies, including assistive devices like screen readers and voice recognition tools.

Numerous technologies demonstrate the real-world application and benefits of accessibility principles. Screen readers assist individuals who are blind or visually impaired by converting text into speech or Braille output. Voice commands enable interaction with devices for users with motor disabilities or limited mobility. Adaptive hardware includes customized keyboards, switches, and gaming controllers designed

for individuals with motor impairments. Mobile accessibility features, such as screen magnifiers, color adjustments, text-to-speech functionalities, and gesture controls on smartphones.

These innovations underscore that accessibility is not theoretical but a tangible reality improving lives daily.

Despite its importance, several challenges persist in the pursuit of accessibility:

- Design complexity. Creating accessible experiences often requires more detailed planning and interdisciplinary collaboration.
- Budget constraints. Accessibility considerations are frequently deprioritized due to perceived additional costs or limited timelines.
- Testing limitations. There is often a lack of comprehensive tools or opportunities for genuine user testing.
- Awareness gaps. Teams may lack sufficient understanding of accessibility needs and best practices, emphasizing the necessity for ongoing education.

To systematically embed accessibility into design and development processes, the following strategies are recommended:

- User research. Involving individuals with disabilities early and consistently throughout the development process.
- Inclusive design. Planning for the broadest range of users from the outset.
- Iterative testing. Engaging in continuous testing and improvement cycles, particularly using assistive technologies.
- Feedback loops. Establishing channels for user feedback to detect issues not captured by automated tools.
- Adherence to Standards: Following the Web Content Accessibility Guidelines (WCAG), which align directly with the POUR principles and serve as a global standard for accessibility.

Accessible design transcends technical requirements; it is a human imperative. By embedding accessibility into the fabric of digital development, we create richer, more inclusive experiences for all users. Accessibility must not be viewed as the

responsibility of a single individual or department but rather as a shared endeavor among developers, designers, researchers, and learners. Through collective effort and intentional design, digital environments that are equitable, sustainable, and universally beneficial can be built.

REFERENCES

1. Shinohara, K., & Wobbrock, J. O. (2016). *Self-Conscious or Self-Confident? A Diary Study Conceptualizing the Social Accessibility of Assistive Technology*. ACM Transactions on Accessible Computing, 8(2), 5.
2. World Wide Web Consortium (W3C). (2024). *Web Content Accessibility Guidelines (WCAG) 2.1*. https://www.w3.org/TR/WCAG21/.

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ARTIFICIAL INTELLIGENCE IN TASK CREATION AND MANAGEMENT IN IT

One of the key areas of AI application in IT is the automation of software development processes, in particular, the creation and description of tasks for the development of new features, design improvement, and analytics. Traditionally, this process required significant time and human resources to formulate and refine project requirements. With the advancement of artificial intelligence technologies, it has become possible to automatically generate tasks based on the analysis of data such as user interfaces, code, previous tasks, documentation, internal team discussions, and more.

Artificial intelligence can analyze large volumes of data available in various formats to automatically create tasks, particularly for improving the design and functionality of software products. AI can process interface screenshots, user session recordings, A/B testing results, user feedback, and product change histories. Based on the analysis results, AI automatically formulates tasks for product improvement. These may include tasks aimed at enhancing UX/UI, optimizing navigation, resolving issues in usage scenarios, or implementing new features [1, 2].

Using machine learning and deep learning methods, AI can also analyze code to identify potential problems or areas for improvement. Such tools are already used in software development to automatically generate tasks for developers based on detected issues in the code. This significantly reduces the time spent on error detection and allows teams to focus on more critical aspects of the project [3].

Another important application is the analysis of documentation and internal team discussions. AI is capable of processing any textual information and identifying key points that can form the basis for new tasks. For example, by analyzing internal emails or chats, AI can automatically formulate tasks based on discussions about product improvement or the addition of new features [1].

The use of AI for automatic task generation significantly enhances the efficiency of development teams, reduces planning time, and ensures greater accuracy in identifying priority areas for product improvement. Implementing such solutions represents a promising step toward increasing productivity and improving software quality. Future development in this field may involve integrating AI systems with project management tools for automatic backlog creation, using generative models to autonomously refine requirements based on incomplete or vague input data. It also includes applying AI to detect hidden dependencies between tasks and to automatically create optimal development plans, as well as using AI for continuous monitoring of changes in code, documentation, and team discussions to dynamically update the list of relevant tasks. These approaches will contribute to deeper AI integration into

development processes, enhance team adaptability, and accelerate product update cycles.

REFERENCES

1. Mukherjee, S. Hasegawa, M. Awadallah, A. H. White, R. (2020). “Smart To-Do: Automatic Generation of To-Do Items from Emails”. URL: https://aclanthology.org/2020.acl-main.767

2. Стало відомо, як ШІ допомагає економити співзасновнику Microsoft Біллу Гейтсу. (n.d.). URL: https://dev.ua/news/iak-bill-heits-vykorystovuie-shi

3. Yadav, P. S. Rao, R. S. Mishra, A. Gupta, M. “Machine Learning-Based Methods for Code Smell Detection: A Survey”. URL: https://www.mdpi.com/2076-3417/14/14/6149

Цивільна безпека:
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THE BLACK SEA IS IN DANGER: ECHOES OF WAR

The Black Sea is a unique body of water that stands out from other seas and oceans. Many rivers flow into the Black Sea, carrying significant volumes of fresh water, so the salinity of the Black Sea is almost twice as low as that of ocean waters. However, its semi-enclosed nature and the presence of a large volume of oxygen-free water make the Black Sea vulnerable to human activity and climate change [Садогурська, 2023].

The war is causing serious environmental damage to the Black Sea: explosions, chemical pollution, oil spillsand and new fish species are changing the ecosystem.

At the same time, the occupiers' undermining of the Kakhovka hydroelectric power station caused large-scale desalination of seawater. This affected marine molluscs, for which the critical sea salinity level of 6,8% is critical. As a result, there was a massive die-off of shellfish. Also, after the explosion of the Kakhovka hydroelectric power station, the presence of chemical elements and oil products was observed, which also affects the ecology of the Black Sea. In particular, this led to plankton blooms [Демідова, Стрельцова, 2025].

On 15 December 2024, two Russian tankers, Volgoneft-212 and Volgoneft-239, sank in the Kerch Strait. As a result of the accident, more than 4,000 tonnes of fuel oil spilled into the Black Sea, causing a large-scale oil slick [Сурова, 2025].

So far, environmentalists have confirmed the deaths of at least 61 dolphins and 700 seabirds. Hundreds of tonnes of contaminated sand have already been found on the Black Sea coast. There is a negative impact of the spill on the marine ecosystem as a whole for all residents. At the moment, it is known that the fuel oil should have

thickened enough even if it is in the middle of the tanker to prevent it from spilling out further, but nevertheless the amount that has entered the sea is enormous [Сурова, 2025].

Scientists estimate that the oil slick has covered tens of thousands of square kilometres of Ukraine's marine protected areas. Covering the water with a thin film, oil prevents oxygen from penetrating, which causes enormous damage to underwater life and often leads to their mass deaths. Oil and fuels and lubricants are toxic to aquatic life, especially to the smallest organisms that form plankton and neuston (a collection of organisms living near the surface of the water). Oil residues can remain on the sea surface for a long time, carried by currents, washed ashore or settle to the bottom, causing problems for many years [Садогурська, 2023].

It is expected that the fuel oil slicks that have settled to the bottom will eventually begin to rise. In the summer, due to rising temperatures, they will become more buoyant, which may facilitate their spread to the coasts of Ukraine, Romania, Bulgaria and Turkey. Especially vulnerable are estuaries with active flows and high-water temperatures. Even if a large mass of fuel oil does not enter the estuaries, there is a threat of chronic pollution by surface oil films that can remain in the sea for years [Сурова, 2025].

This fuel oil is now in a solid state. When it gets warmer, it will dissolve in water, and through the water, through the food chain, it will affect all living things in the Black Sea. And, of course, the people who will use the coast for recreation. Fuel oil is a substance that gradually accumulates and slowly kills a living organism. The peculiarity of fuel oil complicates the situation: it quickly settles on the seabed, where it is almost impossible to eliminate it with technical means. In the absence of timely clean-up, fuel oil residues can be biodegraded over decades, gradually poisoning the marine ecosystem [Сурова, 2025].

The recommendations how to protect people and what to do. At first, avoid swimming in potentially contaminated waters and follow official reports on water conditions. If somebody notice oil products on the beach, immediately inform the local

environmental services. Avoid contact with sand contaminated with fuel oil and do not allow children or pets in such areas. Environmentalists warn of the possibility of long-term pollution. There is also a risk of a decrease in biodiversity in the region.

But the war also had an unexpectedly positive impact. The ban on tourism, fishing and shipping allowed part of the water area to 'rest'.

Artificial reefs will help clean the water, but this requires detailed research. Their incorrect location can even be harmful, as the scientists at the Institute of Marine Biology of the National Academy of Sciences of Ukraine explain their decision of the problems with the Black Sea. Another solution is to develop mariculture, in particular mussel farming. These organisms naturally filter water, removing contaminants from it [Баранцевич, 2024].

REFERENCES

1. Баранцевич О. (2024). Чорне море в небезпеці: відлуння війни долинає за межі кордонів. *Nicenter*. https://nikcenter.org/2024/02/the-black-sea-in-peril-the-echoes-of-war-ripple-beyond-borders/

2. Демідова Л., Стрельцова С. (2025). Як війна змінює Чорне море: забруднення, втрата морських видів та шляхи відновлення. *Суспільне. Одеса*. https://suspilne.media/odesa/928971-ak-vijna-zminue-corne-more-zabrudnenna-vtrata-morskih-vidiv-ta-slahi-vidnovlenna

3. Садогурська С. (2023). Як війна вплинула на Чорне море. *Ukrainer*. https://www.ukrainer.net/viyna-chorne-more/

4. Сурова М. (2025). Мазут в Чорному морі після аварій російських танкерів: ситуація, наслідки та перспективи. *LetsdoitUkraine*. https://letsdoitukraine.org/2025/02/ldu-mazut-v-chornomu-mori/

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ON CHEMICAL HAZARDS IN TIMES OF WAR

As early as 10,000 BC, warring tribes often used various poisons derived from plants and animals to coat spearheads before battles. The modern world witnessed the use of chemical weapons during the First World War, where substances such as chlorine, phosgene and sulphur mustard were used. During the Second World War, Nazi Germany developed new, much more lethal nerve agents (sarin, tabun and soman), although they were never used on the battlefield. The Nazis did, however, combine hydrogen cyanide with an absorbent to form Cyclone B, which was later used to kill millions of people in the gas chambers of concentration camps. Chemical weapons have also been used during the Iran-Iraq war and in modern-day Syria.

At the end of the twentieth century, terrorist groups began to obtain chemical warfare agents and use them against civilian targets. The most famous case was the use of sarin gas in the Tokyo subway by the “Aum Shinrikyo” group (1995). At the same time, a number of countries were clandestinely developing more sophisticated and lethal chemical weapons that were safer to transport but harder to detect. These compounds include binary agents and lesser-known, unconventional agents. Binary agents are 2 chemically stable and non-lethal precursors that are safe to transport separately, but when combined, they become a lethal chemical. Non-traditional compounds, such as “Novichok”, are new generation chemicals with different effects, detection levels and mechanisms of action [1].

For three years, since the start of its full-scale military invasion of Ukraine, Russia has been accusing Kyiv of using chemical weapons without providing any

evidence to support these claims. The absence of evidence raises legitimate doubts about the validity of the accusations, given that chemical attacks usually leave behind a significant amount of physical evidence [2].

In addition, the main chemical hazard in the context of military is posed by enterprises whose technological processes use a large amount of chemicals, and whose tanks can turn into a chemical bomb during shelling and bombardment and lead to massive releases of toxic substances (TS) and chemical damage to civilians. Such enterprises are referred to as chemically hazardous facilities. As a rule, these are enterprises of the chemical, petrochemical and oil refining industries. The hazardous substances in case of possible accidents include chlorine, ammonia (including ammonium nitrate), nitric acid, mercaptans, and hexane.

A special case of chemical hazards is the use of pesticides (organochlorine, organophosphate, metal-containing, etc.) for agricultural purposes, which are stored in agricultural warehouses and, if uncontrolled (for example, due to the impact of a shock wave), lead to contamination of civilian facilities and pose a real threat of mass poisoning of people and animals. The means of delivery of chemical warfare agents do not differ from conventional explosives. Thus, a chemical munitions attack can be disguised and occur during a conventional artillery or air strike, and it is unlikely that workers at the enterprises will be able to distinguish between a chemical and conventional explosion.

Chemical weapons (CW), like nuclear or bacteriological weapons, are indiscriminate. Depending on the substance and the means of dissemination, CW can be used in liquid, solid or gaseous form. CW agents in gaseous or liquid form cause greater exposure than those in solid form.

It is not always possible to quickly identify and confirm the use of chemical agents on your own without the appropriate qualifications. There are several signs that a CW release has occurred: the more signs, the higher the probability (Fig. 1-2).

Workers may be exposed to chemical compounds through primary or secondary contact. In case of ingestion, vomiting should not be induced. In this case, vomit may

lead to repeated burns, so it may be necessary to decontaminate these masses, which may contain residual TS. When providing first aid, appropriate personal protective equipment should be used: gas mask, dust respirator, thick cloth mask.

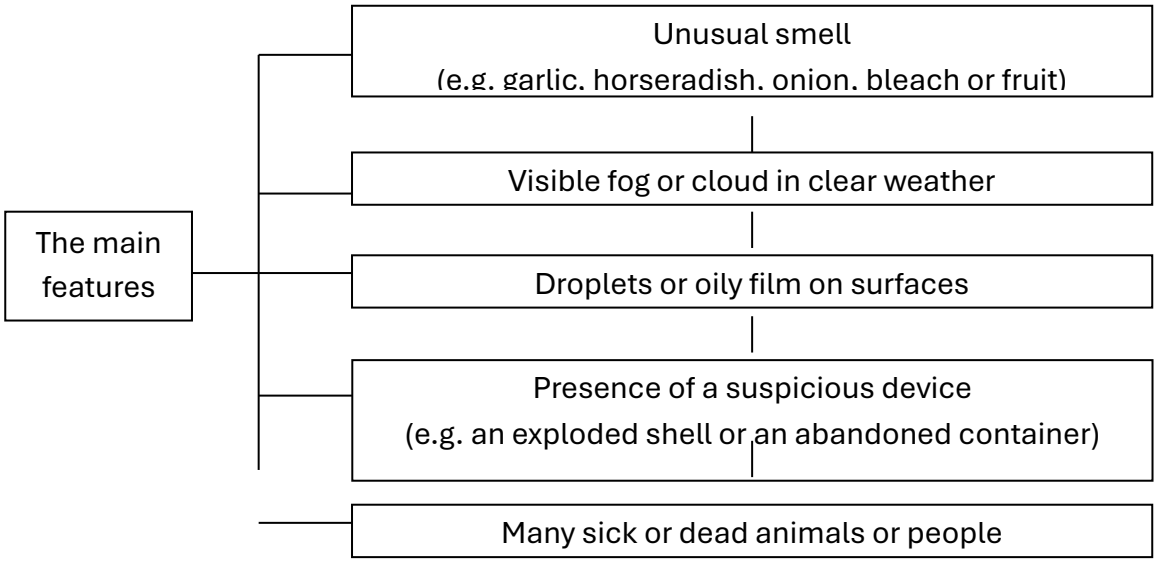

Fig. 1. Signs of toxic substance release

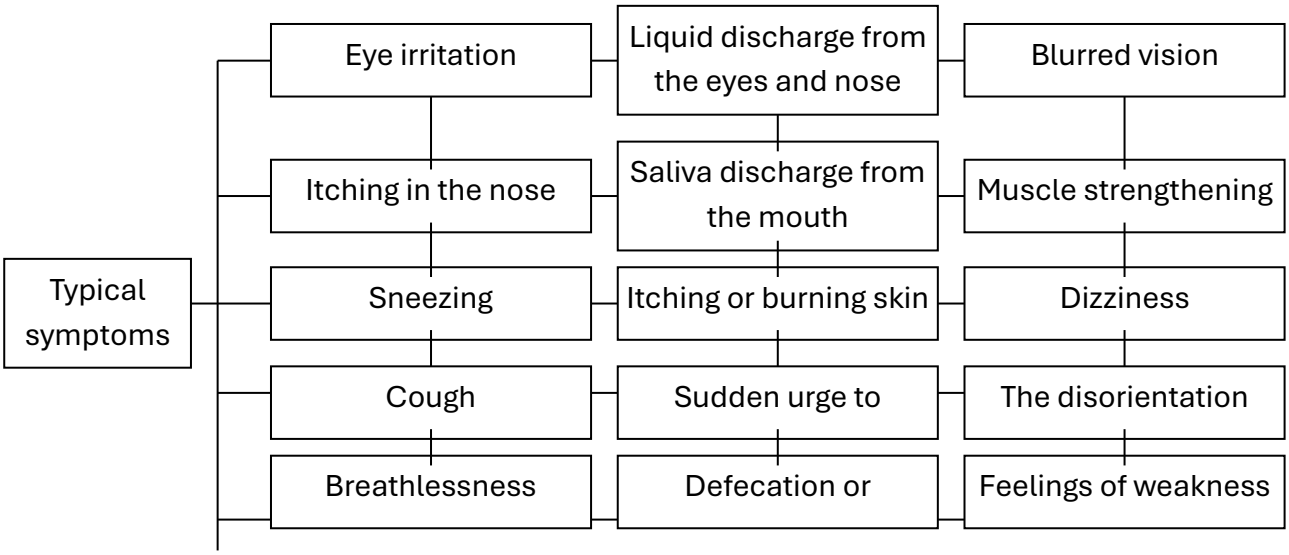

Fig. 2. Symptoms in humans when toxic substances are released

REFERENCES

1. National Consortium for the Study of Terrorism and Responses to Terrorism (START). Global terrorism database. (2017). College Park: University of Maryland.

2. Cherhova dezinformatsiia Kremlia pro khimichnu zbroiu SShA v Ukraini. URL: https://www.holosameryky.com/ (date of application:15.04.2025).

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DEVELOPMENT OF A METHOD BASED ON ARTIFICIAL INTELLIGENCE TECHNOLOGIES FOR MONITORING THE SAFETY OF UNDERGROUND WORKINGS AND STRUCTURES

The safety of underground structures - such as mining shafts, tunnels, utility passages, and metro systems - is a critical issue in modern civil and geotechnical engineering. Due to limited visibility, high humidity, poor air quality, dynamic stress loads, and inaccessibility for manual inspections, ensuring structural integrity in such environments is complex. Failures in underground workings can result in catastrophic consequences, including loss of human life, financial damage, and long-term environmental impact. Traditional monitoring systems, although widely used, rely heavily on human operators and often fail to detect early signs of deterioration or instability. The integration of artificial intelligence (AI) into the safety monitoring processes offers transformative potential in terms of prediction, automation, and resilience.

Conventional inspection techniques for underground infrastructure typically include visual inspections, manual data logging, geotechnical surveys, and laboratory testing of soil or rock samples. These methods are time-consuming, limited in frequency, and often reactive rather than preventive. In many cases, safety threats are discovered only after they become critical, leaving little time for mitigation.

Furthermore, underground environments are subject to complex interactions between geological, hydrological, and mechanical factors. This creates a large volume of multidimensional data that cannot be effectively processed using traditional

engineering methods. The need for automated, intelligent, and self-learning systems that can operate continuously in harsh environments has thus become urgent.

The AI-based safety monitoring method includes a distributed network of intelligent sensors that continuously monitor physical and environmental parameters. These include strain and displacement sensors to detect deformations in structural components, seismic and vibration sensors to identify rock bursts or excessive movement, gas sensors to monitor the concentration of hazardous gases like methane or carbon monoxide, and cameras and LiDAR for real-time visual inspection and 3D modeling. These sensors are installed at critical points throughout the underground structure and transmit data wirelessly to a central processing unit.

Raw data collected from the sensor network undergoes preprocessing, including noise filtering, normalization, and synchronization. The data is stored in cloud-based or edge-based databases to ensure fast retrieval and low latency. The system supports real-time data streaming to allow immediate detection of anomalies.

Various AI models are employed to analyze the sensor data. Supervised learning models are trained on labeled datasets to classify normal vs. abnormal conditions. Unsupervised learning models are used for anomaly detection in cases where labeled data is scarce. Deep learning models, including convolutional neural networks and long short-term memory networks, process images, video streams, and time-series data to detect structural defects and forecast potential failures. The models are retrained periodically using updated data to improve prediction accuracy over time.

An integrated dashboard provides visual representation of the monitored underground environment, highlighting high-risk zones and displaying key indicators. The system can issue automatic warnings or recommendations to operators when predefined risk thresholds are exceeded. In critical cases, the system can trigger automated interventions, such as ventilation activation or structural reinforcement.

Using historical data and AI-driven simulations, the system evaluates long-term trends in structural behavior and forecasts possible failure events. This allows

engineers to schedule maintenance activities before a critical incident occurs, reducing downtime and increasing safety margins.

Pilot implementations of AI-based safety monitoring have already been tested in international mining and tunneling projects. In China, an underground coal mine deployed a deep learning-based methane gas forecasting system that reduced explosion incidents by over 40% in one year. In Norway, the Oslo Metro installed vibration-based AI sensors to detect early signs of track deformation and tunnel lining fatigue. Ukrainian mining enterprises have begun integrating low-cost sensor kits and AI algorithms in experimental zones to assess slope stability in salt and ore mines.

These implementations demonstrate the viability of AI-based systems in improving operational safety, extending infrastructure lifespan, and reducing economic losses. The approach offers real-time monitoring, high sensitivity, predictive capability, automation, and scalability. However, challenges include the need for high-quality data, cybersecurity concerns, integration with existing systems, and initial costs.

AI-based safety systems must align with both national and international safety standards. In Ukraine, integration with DBN V.2.1-10-2009 is essential. At the European level, standards like EN 1997-1:2024 and EN ISO 2394 provide guidelines for safety assessment and reliability-based design. Efforts are also underway to develop AI-specific standards through ISO/IEC JTC 1/SC 42.

The development of an AI-based method for monitoring the safety of underground workings and structures represents a groundbreaking advancement in geotechnical and structural engineering. By combining real-time sensor networks, predictive machine learning algorithms, and intelligent decision-making systems, this approach can significantly improve the safety, efficiency, and resilience of underground facilities.

Ukraine’s transition toward digitalized civil infrastructure, aligned with international standards, provides a fertile ground for the adoption of such technologies. Continued investment in research, pilot projects, and regulatory adaptation will be necessary to fully realize the potential of AI in underground safety monitoring.

Conclusions

The development of an AI-based method for monitoring the safety of underground workings and structures marks a significant step toward more resilient and intelligent infrastructure. By combining advanced sensing technology, robust data analytics, and machine learning, such systems provide early warning capabilities and enhance preventive maintenance. This technological approach aligns with the global trend of digital transformation in civil engineering and presents a valuable tool for improving underground safety in Ukraine and beyond.

REFERENCES

1. BS EN 1997-1:2024 Eurocode 7 - Geotechnical design. Part 1: General rules
2. ISO/IEC JTC 1/SC 42. Artificial Intelligence — Overview of trustworthiness in AI. International Organization for Standardization, 2020.
3. DBN V.2.1-10-2009: Mining Facilities. General Safety Requirements. Kyiv: Ministry of Regional Development of Ukraine.
4. SFPE Handbook of Fire Protection Engineering. 5th Edition. Society of Fire Protection Engineers, 2016.

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ОЗЕЛЕНЕННЯ ПУСТЕЛІ В ХЕРСОНСЬКІЙ ОБЛАСТІ НА ПРИКЛАДІ ДОСВІДУ ВИКОРИСТАННЯ СОЛОМ'ЯНИХ КАНАТІВ

Кількість земель в Україні, що відносять до пустелі становить близько 1 млн гектарів (10 тис. км^2). Ці землі можливо повернути до земель сільськогосподарського призначення або до лісництва. Саме для цього необхідно застосувати досвід Китаю. Ця країна активно бореться з пустелями на своїй території. За офіційними даними, у період з 2016 по 2020 рік Китай перетворив

на зелені насадження близько 8,8 млн гектарів пустельних земель. За рахунок коренів рослин блокуються пересування піску, через що пустеля дедалі менше розширюється. У пустелях немає захисту від вітру, через що його швидкість може досягати високих показників.

Тому був знайдений спосіб боротьби – солом’яні канати. Солома розташовується на піщаних дюнах, просто на піску або на інших посушливих площах ось такими клітинами.

Рис. 1 Клітини з солом’яних канатів

У великих масштабах виходить свого роду величезна шахівниця, що складається з сотень або тисяч осередків.

Такі солом'яні осередки - це чудовий спосіб отримання поживних речовин для рослин. Спочатку на дюнах та іншій посушливій території викладаються солом'яні шахові дошки. Потім всередину кожного осередку поміщаються насіння стійких до місцевих умов рослин, на кшталт якого-небудь чагарника або відповідного дерева. Кожен солом'яний канат розкладатиметься протягом 3 років, після чого на їхньому місці з'являться живі трав'яні загородження, які зроблять дюни зеленими. У механічно створених солом'яних канатів на заводах термін служби складає близько 6 років. З'явився також транспорт, у якому можна розмістити солому, а потім просто їздити обраною піщаною місцевістю. Їх використання у чотири-шість разів ефективніше, ніж ручні роботи з укладання солом'яних осередків.

Рис. 2 Спеціальні машини для укладання солом’яних канатів

В Україні існує найбільша європейська пустеля - Олешківські піски. Вона знаходиться в Херсонській області та займає площу 1612 км², а якщо враховувати не покриті пісками території 2100 км².

Рис. 3 Найбільша пустеля Європи - Олешківські піски

Боротьба з пустелею ведеться вже давно такими методами як:

1. Лісозахисні насадження – висаджені соснові ліси
2. Обмеження антропогенного навантаження - регулювання випасу худоби, обмеження нелегального туризму, заборона вирубки лісів
3. Наукове дослідження та моніторинг - участь беруть вчені з ботанічних та екологічних інститутів України, які досліджують стан піщаних ґрунтів, зміну рослинності та ефективність протипустельних заходів

Це пустеля викликає низку проблем, головні з яких:

1. Опустелювання та деградація земель – в зв’язку з нераціональним випасом худоби та вирубкою лісів
2. Лісові пожежі - щороку у весняно-літній період відбуваються масштабні пожежі в соснових лісах, які висаджені для стабілізації пісків.

Тому для боротьби з пустелею в Україні можливо використання методів, які довели свою ефективність на практиці. Зокрема, впровадження технології створення клітин із солом'яних канатів може стати дієвим рішенням для стабілізації піщаних дюн та запобігання подальшому поширенню пісків в Олешківських пісках. Такий підхід дозволить не лише зменшити швидкість вітру біля поверхні землі, а й створити сприятливі умови для проростання спеціально підібраних, стійких до посухи рослин. Завдяки цьому піщані території можуть поступово перетворитися на стабільні екосистеми з багатим рослинним покривом, що зменшить ризик деградації ґрунтів, покращить мікроклімат регіону та стане прикладом екологічної реабілітації для інших посушливих зон України.

ЛІТЕРАТУРА

1. Lou, Y., et al. (2022).Effects of Distributions of Grass Strips on Soil Erosion in Spoil Tips. Журнал: Water, 14(6), 913. DOI: 10.3390/w14060913
2. Zhang, X., et al. (2018). Effects of grass strips distribution on soil erosion and its optimal location on convex hillslopes. Журнал: Catena, 171, 57–65. DOI: 10.1016/j.catena.2018.07.007
3. Zhang, Z., & Huisingh, D. (2018). Combating desertification in China: Monitoring, control, management and revegetation. Журнал: Journal of Cleaner Production, 182, 765–775. DOI: 10.1016/j.jclepro.2018.01.233

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HEALTH AND SAFETY AT THE CONSTRUCTION SITE

Construction sites are ones of the most dangerous workplaces in the world.

Construction workers face significant risks, including working at heights, lifting heavy objects, operating hazardous machinery, and being exposed to dangerous

substances like asbestos. However, these dangers are not limited to workers on-site. Accidents involving children and members of the public can also occur when construction activities are not properly managed. This is why prioritizing health and safety is essential before starting any construction project. Although, it is impossible to eliminate every hazard at the construction site, implementing strong health and safety measures can significantly reduce the likelihood of injuries and occupational illnesses [3].

One of the most effective ways construction companies can improve health and safety is training offered to workers or hiring pre-qualified contractors who have already received health and safety training. Additionally, employees, contractors, or visitors who enter the site for the first time must be informed about site-specific hazards and equipped with personal protective equipment (PPE) [1].

Falls are the leading cause of accidental fatalities in the construction industry. Therefore, any task involving work at height requires specific safety measures to either prevent falls entirely or reduce the risk of injury should a fall occur. Whenever possible, tasks at height should be avoided. When such work is necessary, appropriate equipment such as scaffolding, safety nets, or cushioned landing systems should be used. Moreover, scaffolding must only be designed, assembled, modified, or dismantled by qualified professionals under proper supervision [5]. It is necessary to minimize the risk of accidentally dropping the tool down from scaffolding. And, it would also be recommended to hang a safety net for additional protection. Tips to minimize accidents at height are as follows:

- Additional guardrails;
- Safe scaffolding ladders;
- Continuous decking on tiers;
- Safety nets and belts.

In addition, electrical equipment is used at almost every site. Everyone is familiar with it, but unlike most other hazards, which can be seen, felt or heard, there is no advance warning of danger from electricity. Hazards arise through faulty

installations, lack of maintenance and abuse of equipment. Therefore, electrical systems and equipment must be properly selected, installed, used and maintained [2].

It is important to note that power lines come in many shapes and sizes. When building staff is working at the construction site, many other contractors are supposed to work there; therefore, there is a great need to be vigilant. Setting up scaffolding at the job site can be dangerous if not to look up and ahead to spot potential power lines, phone lines, or simply wires that are not yet connected. One may find oneself in the same area as an electrical crew or set up scaffolding for electricians. At some point, there may be live electrical wires in and around the work area. Safety tips around power lines should be as follows:

- Always look up;
- Wear rubber-soled safety boots;
- Do not touch exposed wiring;
- Consult an on-site electrician if in doubt.

Each year, construction site accidents, which involve moving or overturning vehicles, result in fatalities and serious injuries. These risks can be significantly reduced through effective management of vehicle and mobile equipment operations.

One key method of preventing collisions is to implement appropriate speed limits tailored to specific site routes. These limits should be clearly marked, and physical deterrents like speed bumps can be used to enforce them. Reversing vehicles also present a major hazard. To reduce this risk, the site layout should be designed to eliminate or minimize the need for reversing whenever possible [5].

A construction company’s approach to health and safety can greatly influence its reputation. Clients are often reluctant to work with firms that do not prioritize safety, and a poor safety record can make it difficult to retain skilled employees. Both clients and workers prefer to engage with companies that ensure a safe working environment. Firms that actively manage construction risks are viewed as more reliable, as they proactively identify and address potential problems, helping to prevent unexpected setbacks during projects [4].

In conclusion, it should be noted that the construction industry remains one of the most hazardous workplaces, but the vast majority of its associated risks can be avoided with proper health and safety measures.

REFERENCES

1. *Construction Risk Management – A Guide to Risk Management in the Construction Industry*. (2025). https://www.theaccessgroup.com/en-au/construction/resources/construction-risk-management/

2. Electricity – Systems in Buildings. (n.d.). https://www.hse.gov.uk/construction/safetytopics/systems.htm

3. McKinnon, Ian. (2020). Why Building Site Health and Safety Matters. https://www.chas.co.uk/blog/building-site-safety-matters/

4. Wong, Q., Waris Ali Khan, M. (2023). The impact of safety and health issues on the construction workforce productivity in Malaysia. https://www.researchgate.net/publication/370782613

5. Younger, Rob. (2017). Beware Construction Site Horrors With Our Guide to Health and Safety On-Site. URL: https://www.thenbs.com/knowledge/beware-construction-site-horrors-with-our-guide-to-health-and-safety-on-site

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UNDERGROUND PLACEMENT OF ENERGY FACILITIES AND CRITICAL INFRASTRUCTURE AS A STRATEGY FOR ENHANCING CIVIL SECURITY IN THE FACE OF MODERN THREATS

The underground placement of power plants is a technologically complex but promising solution that offers significant advantages as well as serious drawbacks. Such power plants provide a high level of security as they are protected from natural disasters (hurricanes, earthquakes, floods), terrorist threats, and military attacks. Their operation has a lesser environmental impact: they do not occupy large surface areas,

reduce noise pollution, preserve the landscape, and help lower atmospheric emissions through effective filtration systems.

The main advantages of underground power plants are:

1. **Protection from Natural Disasters.** Underground power plants are significantly less exposed to extreme weather conditions and are protected from wildfires and even earthquakes if designed with seismic risks in mind.

2. **Enhanced Security.** Underground placement makes it much harder for attacks or sabotage to occur, which is relevant during conflicts or terrorist threats.

3. **Reduced Emissions and Air Pollution.** Some types of power plants, especially those that run on fossil fuels, produce harmful emissions. Underground placement allows for easier control and filtration of these emissions before they reach the atmosphere.

4. **Utilization of Residual Thermal Energy.** Underground power plants can be designed to use excess heat for heating other underground facilities or even residential and industrial areas through a geothermal heating system.

5. **Efficient Land Use.** Underground power plants allow for the use of underground space for energy infrastructure, freeing up surface areas for agriculture, urban development, or natural ecosystem preservation.

The main disadvantages of Underground Power Plants are:

1. **High Construction Costs.** One of the biggest challenges is the significantly higher initial costs compared to surface power plants. Designing, tunneling, reinforcing walls, and creating specialized ventilation and waterproofing systems require large financial investments. Additionally, advanced monitoring technologies may be needed to ensure structural stability and protection against underground shifts.

2. **Limited Access for Maintenance**. Underground placement makes regular repairs and equipment maintenance more challenging. If a malfunction or accident occurs, repair teams may face difficulties due to limited space and restricted access to critical components.

3. **Flooding Risk**. Any underground structure requires an effective drainage system and protection against groundwater. Poor planning in these aspects can lead to flooding, potentially causing power outages, short circuits, and other hazardous situations.

4. **Ventilation and Cooling Challenges**. Underground spaces have limited access to fresh air, requiring powerful ventilation and heat dissipation systems. High-temperature equipment, such as turbines and transformers, needs efficient cooling, which is more complex to achieve in enclosed spaces. A ventilation system failure could quickly increase CO_2 levels, making the working environment dangerous.

5. **Longer Construction Time**. Due to the complexity of designing and constructing underground facilities, their development takes longer than conventional power plants. This can delay commissioning and require additional financial and technical resources.

Overall, underground power plants offer significant advantages, particularly in urbanized areas, amid climate change, and under increasing energy security demands. However, they require careful planning and substantial initial investments.

Соціальні та поведінкові науки: людина в динамічному світі

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ГЛОБАЛЬНИЙ ВИМІР УКРАЇНСЬКИХ СТУДІЙ: ДОСВІД СТРАТЕГІЧНИХ СЕСІЙ «УКРАЇНСЬКІ СТУДІЇ В СЛАВІСТИЦІ: ВІЗУАЛІЗАЦІЯ»

З початком повномасштабного вторгнення росії на територію України відбулось значне зростання інтересу до вивчення української тематики в світі, що в свою чергу не є виключно реакцією на політичну ситуацію в країні, а радше пов'язано з визнанням унікальності Української держави в світовій історії. На сьогоднішній день українську мову та культуру вивчають у понад 160 осередках 30 країн світу (Коваль et al., 2022), що сприяє переосмисленню української історії та ролі України, деколонізації знань та позбавленню від російської інтерпретації. У широкому визначенні діяльність українських студій покликана сформувати позитивний імідж України та її об'єктивне сприйняття в інших країнах, протидіяти російським наративам, зберегти українську ідентичність як всередині, так і за межами країни.

У 2024 році МОН, МЗС, Фонд Президента з підтримки освіти, науки та спорту, Український інститут та Офіс Кримської платформи об'єднались з метою запровадження *Глобальної коаліції українських студій* (МОН, 2024). Ця ініціатива була також підтримана першою леді Оленою Зеленською. Головною метою створення *Коаліції* є об'єднання всіх ініціатив, спрямованих на вивчення та дослідження української культури, історії, мови та літератури.

Одним з проєктів Офісу підтримки вченого, що був створений Радою молодих учених при МОН України, є **Цикл стратегічних сесій «Українські**

студії в славістиці: візуалізація». Проєкт спрямовано на переосмислення місця і ролі українських студій в сучасній славістиці, розуміння значення бренду та іміджу України у світовому просторі (Офіс підтримки вченого, 2025).

Заходи із циклу стратегічних сесій «Українські студії в славістиці: візуалізація» в основному зосереджені на висвітленні тенденцій розвитку україністики в сучасних умовах, наявних викликах та перспективах їх подолання, а також зміні ролі України, що може призвести в майбутньому до актуалізації українського наративу та зміни парадигми славістичних студій. Робота стратегічних сесій реалізовується за такими напрямами (Офіс підтримки вченого, 2025):

Напрям 1. ***Переосмислення архітектури сучасної славістики.***

Напрям 2. ***Представлення українських студій у світі.***

Напрям 3. ***Візуалізація України: національна ідея та українська ідентичність.***

Напрям 4. ***Деколонізація і значення україністики у славістиці.***

За весь період реалізації проєкту було проведено десять стратегічних сесій, учасниками заходів стали науковці, дипломати, здобувачі вищої освіти, представники громадських організацій та інші особи, зацікавлені в дискусійних питаннях стратегічних сесій. Тематика студій охоплювала питання вивчення та просування української мови та культури закордоном, а також розгляду ролі української діаспори як провідного рушія змін (Офіс підтримки вченого, 2025):

– ***І стратегічна сесія «Українські студії в славістиці: візуалізація».***

– ***ІІ стратегічна сесія «Українські студії в славістиці: візуалізація», тема: «Проблеми ідентичності культурної спадщини України».***

– ***ІІІ стратегічна сесія «Українські студії в славістиці: візуалізація», тема: «Представлення українських студій у світі».***

– *IV стратегічна сесія «Українські студії в славістиці: візуалізація», тема «Українська мова як іноземна: досвід викладання в Україні»*

– *V стратегічна сесія «Українські студії в славістиці: візуалізація»,*

тема «Вивчення української мови за кордоном: нові можливості»

– *VI стратегічна сесія «Українські студії в славістиці: візуалізація», тема «Роль діаспори у поширенні українських студій у світі»*

– *VII стратегічна сесія «Українські студії в славістиці: візуалізація», тема «Завдання і повноваження Національної комісії зі стандартів державної мови в контексті українського законодавства. Іспити на рівень володіння державною мовою»*

– *VIII стратегічна сесія «Українські студії в славістиці: візуалізація», тема «Іноземний досвід роботи з діаспорою»*

– *IX та X стратегічні сесії «Українські студії в славістиці: візуалізація» , тема «Українські студії у Франції»*

Результатами реалізації ініціативи з розвитку українських студій та проведення стратегічних сесій стало розширення академічної мережі науковців і дослідників славістів, укріплення міжнародного іміджу України, підсилення впливу наукової діаспори у світі, і особливо у Німеччині та Франції, де науковці об'єдналися в потужні осередки для проведення форумів, конференцій, спільних досліджень та написання наукових праць. Кожен із цих результатів сприятиме зміцненню позицій України як незалежного, самодостатнього центру славістичних і гуманітарних досліджень та підвищенню її культурного і наукового впливу на глобальному рівні.

ЛІТЕРАТУРА

1. Коваль, Н., Гайдай, О., Мельник, М., Процюк, М., Терещенко, Д., & Ірисова, М. (2022). *Українські і кримськотатарські студії за кордоном: дослідження стану і потреб*. Київ: Український інститут.

2. МОН. *Поширюємо знання про Україну: ініційовано запуск Глобальної коаліції українських студій.* (2024). Retrieved from: https://mon.gov.ua/news/poshyriuiemo-znannia-pro-ukrainu-initsiiovano-zapusk-hlobalnoi-koalitsii-ukrainskykh-studii

3. Офіс підтримки вченого. *Українські студії в славістиці: реалізація*. (2025). Retrieved from: https://sso.org.ua/proyekty/

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THE ROLE OF THE STATE IN THE DEVELOPMENT OF UKRAINE'S ECONOMY AND CONSTRUCTION SECTOR UNDER MARTIAL LAW

Since the imposition of martial law on February 24, 2022, Ukraine's economy has faced unprecedented challenges. Ensuring economic functionality is vital. Military resistance is critically needed to sustain national resilience and prevent attrition of state economy. The construction sector acts as a locomotive for allied industries: production of building materials, metallurgy, energy, logistics and design services. Its revival is crucial for generating revenues for construction companies. These revenues generate tax income, employment opportunities, and stimulate domestic consumption. Wartime challenges increased the importance of state economic policy. Therefore, this topic remains highly relevant.

Active hostilities and regional displacement shifted construction activity in Ukraine westward. There were over 7 million internally displaced persons as of January 2023 (Жовтяк and others, 2024). Financing reluctance among banks and uncertainty suppressed private investments in construction. Rising costs of materials and logistics under wartime conditions demand state mechanisms to stabilize input supply and credit availability. Ukraine, as a state, implemented practical measures to regulate its economy:

1. National Recovery Council was established – an advisory and consultative body under the President of Ukraine to coordinate post-war recovery planning across 23 sectors;

2. The Ukraine Recovery Plan was prepared and is based on five principles: immediate onset and gradual scaling; equitable prosperity; EU integration; "build back better" nationally and regionally; stimulation of private investment. It allocates > US $750 billion over 10 years with "Housing and Infrastructure Recovery" as the largest cluster (150–250 billion USD across 103 projects) (*ПЛАН ВІДНОВЛЕННЯ УКРАЇНИ*, 2022);

3. Two significant housing programs were launched

- eHome: concessional mortgage financing for military personnel, teachers, healthcare and research workers (*ЄОСЕЛЯ*, 2022);
- eRecovery: targeted cash aid for owners of war-damaged housing to procure construction materials and reconstruction works via partner networks (*ЄВІДНОВЛЕННЯ*, 2023);

4. State procurement of realty was initiated – the government initiated the purchase of housing stock for families with military heroes;

5. The Ukrainian government facilitated reduction of duties in Europe on the Ukrainian goods and thus contributed to maximization of Ukrainian export to EU;

6. Restriction of trade and business with the country that invaded the territory of Ukraine and with country that deployed foreign military personnel on their territory for invasion into the territory of Ukraine;

Implementation of major infrastructure projects of state under the "Housing and Infrastructure Recovery" cluster will speed up the development of construction industry. Energy-efficient retrofits, barrier-free design, social and temporary housing acquisition and new utility networks will strengthen economy, rebuild Ukraine and change it into the country with a high standard of living. Ukraine will attract private and institutional international investments. This will take place by means of enhancing legal frameworks, expanding public–private partnerships, and aligning with EU standards. Further liberalization of customs and the existence of security guarantees will strengthen investor's confidence.

There is urgent need to attract substantial investments for the reconstruction of Ukrainian war-damaged infrastructure and energy sector. The population and business share the position that the reconstruction of Ukraine will last up to 10 years or more — this opinion was expressed by 60% of businesses and the population (*Research - Transparency International Ukraine*, 2023).

Passed in early 2024, the European Union's €50 billion Ukraine Facility is meant as an integrated strategy. The best-publicized part, pillar one, covers €17 billion in grants and €33 billion of loans from 2024 through 2027 (*Reconstructing Ukraine at war: The journey to prosperity starts now*, 2024).

Ukraine has rapidly activated comprehensive state instruments to support the economy and construction sector. Ukraine avoided delays and the expectation that recovery should begin only after hostilities end. Continued execution of the Recovery Plan's projects and expansion of investment-friendly policies will be pivotal for long-term economic resilience and growth. Further research should be conducted on what was done in Europe and Japan after World War II for the recovery of their economy and what Ukraine can execute more.

REFERENCES

1. *Reconstructing Ukraine at war: The journey to prosperity starts now*. (2024). Atlantic Council. https://www.atlanticcouncil.org/in-depth-research-reports/report/reconstructing-ukraine-at-war-the-journey-to-prosperity-starts-now/

2. *Research - Transparency International Ukraine*. (2023). Transparency International Ukraine - Як відбудовувати Україну. https://ti-ukraine.org/research/yakvidbudovuvaty-ukrayinu-sotsiologichne-opytuvannya-gromadyan-ta-predstavnykiv-biznesu/

3. *ЄВІДНОВЛЕННЯ*. (2023). ЄВІДНОВЛЕННЯ. https://erecovery.diia.gov.ua/.

4. *ЄОСЕЛЯ*. (2022). ЄОСЕЛЯ. https://eoselia.diia.gov.ua/.

5. Жовтяк, Г., Богданов, Р., & Жовтяк, А. (2024). ПРОБЛЕМИ ТА ПЕРСПЕКТИВИ РОЗВИТКУ БУДІВЕЛЬНОЇ ГАЛУЗІ УКРАЇНИ В УМОВАХ ВІЙНИ. *Економіка та суспільство*, (62). https://doi.org/10.32782/2524-0072/2024-62-128

6. *ПЛАН ВІДНОВЛЕННЯ УКРАЇНИ*. (2022). ПЛАН ВІДНОВЛЕННЯ УКРАЇНИ. https://recovery.gov.ua/.

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СУСПІЛЬСТВО ЯК СИСТЕМА, ЩО РОЗВИВАЄТЬСЯ: ЕВОЛЮЦІЯ ТА РЕВОЛЮЦІЯ

Суспільство - це складний організм, який живе і розвивається як будь-яка інша система. У процесі свого існування воно стикається з безліччю змін, які можуть бути як еволюційними, так і революційними. У розумінні цих процесів надзвичайно важливо розрізняти два основних підходи - еволюцію і революцію і усвідомлювати їх вплив на суспільний розвиток.

Еволюція-це процес змін, який поступово відбувається в суспільстві протягом часу. Ці зміни можуть включати соціальні, культурні, економічні та технологічні аспекти. Еволюційний підхід акцентує увагу на тому, як невеликі кроки і адаптації можуть призводити до значних зрушень в суспільстві.

Основним принципом еволюції є адаптація. Суспільство, як жива система, має постійно адаптуватися до мінливих умов навколишнього середовища. Це може бути викликано новими технологіями, змінами в природі або культурними зрушеннями. Одночасно відбуваються зрушення в суспільній свідомості, які дозволяють людям приймати нові норми і цінності.

На прикладі впровадження технологій: в останні десятиліття розвиток інтернету та мобільних технологій кардинально змінив наш спосіб взаємодії та спілкування. Ці зміни не відбувалися одномоментно, вони були результатом багаторічного прогресу в галузі науки і техніки/

На відміну від еволюції, революція характеризується швидкоплинними, в порівнянні з еволюцією, і радикальними змінами в суспільстві. Революційні процеси часто відбуваються в екстремальних умовах, коли існуюча система втрачає свою легітимність і не може відповісти на потреби населення [1, с.213].

Революції можуть бути науковими, технічними, соціальними. Соціальні революції часто супроводжуються конфліктами і жертвами. У той час як науково-технічні революції можуть обходитися без відкритого насильства, проте вони також призводять до значних змін у політичній системі. Ключовим моментом у будь-якому революційному процесі є соціальне невдоволення. Коли люди відчувають, що їхні потреби ігноруються, це може призвести до масових протестів і вимагати різких змін.

Французька революція 1789 року — це один із знакових прикладів радикальних змін, який не тільки змінив політичну структуру Франції, але і справив глибокий вплив на інші країни. Революція підштовхнула до поширення ідей свободи, рівності і братерства, що стало основою для майбутніх громадянських рухів по всьому світу.

В реальності еволюція і революція часто переплітаються. Еволюційні зміни можуть створювати умови для революційних сплесків, а революції можуть сприяти початку еволюційного процесу. Наприклад, успішні революції можуть призвести до створення нової соціальної системи, яка потім почне розвиватися. У цьому контексті мова може йти про кругообіг змін, де кожен процес збагачує інший.

Синергія між еволюцією та революцією дозволяє суспільствам адаптуватися, не втрачаючи своєї ідентичності. Еволюційні зміни допомагають створити основу, на якій можуть відбуватися революційні зміни. Наприклад, розвиток знань і освітніх систем часто передує революційним течіям, забезпечуючи суспільство ідеями і критичним мисленням.

Соціальні рухи часто стають каталізаторами як еволюційних, так і революційних змін. Вони можуть виникати на основі невдоволення існуючими умовами та вимагати змін у соціальній, політичній чи економічній сферах. Приклади соціальних рухів включають боротьбу за права людини, екологічні рухи та антидискримінаційні кампанії [2, с. 230].

Суспільство як система, що розвивається являє собою складний механізм взаємодії між еволюційними і революційними процесами. Еволюція дає нам можливість поступово адаптуватися до змін, зберігаючи ідентичність та стійкість. Революція ж створює раптові повороти, здатні кардинально змінити напрямок розвитку суспільства.

Вивчення цих процесів є важливим не лише для розуміння історичного контексту, а й для формування стратегії сталого розвитку суспільства в майбутньому. Суспільство завжди буде поєднувати в собі елементи, як еволюції, так і революції, що робить його існування динамічним і багатогранним.

ЛІТЕРАТУРА

1. Сорокін, П.А. (2022). Загальні принципи цивілізаційної теорії та її критика. Київ: ЮНІТІ.
2. Кун, Т. (2021). Структура наукових революцій. Київ: Університет.

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THE INFLUENCE OF PSYCHOSOMATIC FACTORS ON SOCIAL AND EMOTIONAL LIFE OF A PERSON

The article is devoted to the analysis of factors that influence psychosomatic manifestations in the human body. Psychosomatic manifestations in the human body can occur under the influence of several psychological, physiological and social factors. Chronic or intense stress can cause somatic symptoms such as headaches (migraines), gastrointestinal disorders (irritable stomach and bowel syndrome), increased temperature, blood pressure and others. Stress activates the sympathetic

nervous system and the hormone system, which causes various psychosomatic manifestations in the body. (Beck, 2019, p.31).

Prolonged anxiety, depression and panic attacks can cause pain, sleep disturbances, gastrointestinal problems and even heart disorders. These emotional states affect the level of cortisol, adrenaline and other stress hormones. Post-traumatic stress disorder (PTSD): (e.g. violence, loss of loved ones, emotional alienation) can be stored in the psyche and later manifested through physical manifestations and diseases in adulthood.

The absence of emotional support leads to social isolation (sociophobia). People who do not have emotional support from others are more prone to psychosomatic disorders. Feelings of loneliness and social isolation from other people have a negative impact on health, causing conditions such as chronic fatigue and immune system disorders.

Certain character traits, such as a tendency to perfectionism, anxiety, a tendency to internalize control and repress emotions, increase the risk of psychosomatic disorders. For example, people with alexithymia (the inability to express emotions) often experience physical symptoms on the back of emotional stress. Unmet needs and internal conflicts (neurotic states): When a person has repressed desires or internal conflicts that cannot find a way out, it can manifest as physical symptoms such as pain, muscle tension, fever and other somatic manifestations. (Beck, 2019, p.38).

People with psychosomatic symptoms (e.g., headaches, chronic fatigue) may avoid social contacts, which leads to isolation in communication with people (sociophobia) and a decrease in quality of life. Constant physical discomfort can cause or exacerbate emotional disorders, including anxiety and depression, which negatively affects social adaptation. Prolonged stress activates psychosomatic reactions, which affects work, personal relationships and overall life satisfaction.

People experiencing somatic manifestations due to emotional stress often lose the ability to establish new social connections or maintain existing ones due to physical and emotional discomfort. Physical symptoms as a way of avoiding social

commitments cause psychosomatic symptoms as a defensive mechanism to avoid unpleasant social situations or commitments. Frequent psychosomatic symptoms can reduce performance and limit career opportunities, which affects self-realization and emotional state of a person. (Fiedler, Khani, 2020, p. 17)

Psychotherapy, in particular cognitive behavioral therapy (CBT), helps to reduce the intensity of somatic symptoms and improve social interactions. Such factors as fast-paced lifestyles, social instability and digital technologies can trigger emotional distress that manifests in psychosomatic symptoms. Physical discomfort caused by psychosomatic causes can affect relationships, causing misunderstandings and reduced emotional intimacy. (Fiedler, Khani, 2020, p. 26)

REFERENCES

1. Beck, A. (2019). Cognitive therapy for depression. CBT Association (2nd ed.).
2. Fiedler, F., Khanin,Y. (2020). Diagnostic Scale of Collective Psychological Climate: Methodological Recommendations. London.

Гуманітарні науки: сучасні виклики та перспективи розвитку

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ГЕНДЕРНИЙ ВИМІР КОМУНІКАЦІЇ

У сучасному суспільстві зростає увага до вивчення гендерних стереотипів через їх відображення у прислів'ях та приказках. Це є частиною інтегрованого антропоцентричного підходу до дослідження лінгвістичної експлікації гендеру. Дослідження спрямоване на аналіз проблеми мовної об'єктивації гендерних стереотипів, що стає важливим кроком у розумінні та розв'язанні проблем гендерної нерівності.

Українське та зарубіжне мовознавство представлені широким спектром досліджень, які охоплюють аналіз концептуального змісту ґендеру на різних рівнях мови. Це включає аналіз лексичного складу (наприклад, дослідження О.Л. Бессонової, О.С. Бондаренко, О.В. Дудоладової, М.С. Колеснікової, О.С. Волинчик), фразеологічних виразів (роботи І.В. Зикової, Д.Ч. Малішевської), паремій (дослідження Ю. В. Абрамової, А. В. Кириліної), а також соціолінгвістичні дослідження (роботи Є. М. Бакушевої, Н. Ф. Верхоланцевої, О. Д. Петренко), аналіз мовленнєвої поведінки статей у мовленні (роботи Н. Д. Борисенка, О. Л. Козачишини), та психолінгвістичні дослідження (роботи О. І. Горошка, С. К. Табурової, А. М. Холод).

Прислів'я та приказки відображають культурні уявлення та стереотипи, пов'язані з ролями чоловіків і жінок у суспільстві. Їх аналіз дозволяє виявити і усвідомити таємні механізми мовної об'єктивації гендерних ролей, що впливають на уявлення про гендерну ідентичність та соціальну взаємодію між статями. Це важливо для формування більш еквітабельного та рівноправного суспільства.

Дослідження прислів'їв та приказок з гендерною перспективою допоможе виявити та аналізувати наявні стереотипи, а також розглянути їх вплив на мовну та соціальну реальність. Цей підхід сприятиме усвідомленню та переосмисленню гендерних ролей, а також сприятиме створенню інклюзивного мовного середовища, де кожна людина має рівні можливості та права.

Мовне конструювання гендерних стереотипів у науковій літературі та порівняння їх з ідеальними зразками маскулінної та фемінної поведінки, репрезентованими у текстах українських народних прислів'їв та приказок (наприклад, стереотип «чоловіча пристрасть до їжі»: як молодим бував, то сорок вареників їдав, а тепер хамелю-хамелю і насилу п'ятдесят умелю; стереотип «чоловіки розумніші за жінок»: за хорошим чоловіком і свинка господинька; стереотип: «чоловіча робота»: для нашого Федота не страшна робота; стереотип «жіноча робота»: дарма, що кума бліда, аби пиріг спекла).

Дослідження проблем відносин між чоловіками та жінками є однією з актуальних тем сучасності. Проте питання ґендеру охоплює глибше і більш різноманітні аспекти. У мовознавстві ґендер є об'єктом дослідження, який має складний та перспективний характер. Інтерес до нього постійно зростає.

Сучасне мовознавство розглядає різні аспекти ґендерних особливостей та характеристик. Дослідження зосереджені на виявленні семантичних особливостей та використання мовних одиниць на всіх рівнях мови, а також на вербальних стереотипах, що впливають на сприйняття чоловіків та жінок. Психолінгвістичні теорії також досліджуються з урахуванням «жіночої» та «чоловічої» мов, аналізуючи мовленнєву поведінку представників різних статей.

Дослідження мови у ґендерному аспекті може проводитися з різних підходів і напрямків. Часто лише їхній синтез забезпечує глибокий аналіз мовних явищ. Треба також пам'ятати, що ґендер не завжди визначає комунікативну поведінку, оскільки вона може змінюватися залежно від ситуації. Одна й та ж людина може вести себе по-різному в різних комунікативних ситуаціях і демонструвати різну мовленнєву поведінку.

У соціолінгвістиці, де аналізується функціонування мови в групах людей за такими ознаками, як вік, стать, професія, досліджуються гендерні аспекти мови. У психолінгвістиці вивчається специфіка асоціацій представників протилежних статей, що також має важливе значення для розуміння ґендерних відмінностей у мовленні. Лінгвокультурологія досліджує специфіку ґендера з культурологічного погляду, що також впливає на мовну практику та поведінку.

Ці напрямки не взаємовиключають один одного, а скоріше доповнюють один одного, що дозволяє отримати більш повне розуміння впливу гендеру на мову та комунікацію. Вони співіснують і сприяють вивченню гендерних відмінностей у мовленні та їх взаємодії з культурним контекстом.

Отже, гендерні ознаки мовної картини світу відображають спосіб сприйняття та розуміння світу через призму гендерних ролей та вплив статі на мовну практику та поведінку. Ці гендерні відношення у мові виявляються у вигляді стереотипів, які впливають на мовленнєву поведінку та соціалізацію особистості.

Розвиток гендерної лінгвістики в сучасному світі включає різноманітні напрямки досліджень, спрямованих на вивчення відмінностей у мовній поведінці чоловіків і жінок. Ось деякі з цих напрямків:

Вивчення лексичної та граматичної системи мови: Метою цього напрямку є встановлення різниці у використанні слів, фраз, граматичних конструкцій між представниками різних статей. Дослідження виявляють, які слова або конструкції є характерними для чоловічої або жіночої мови.

Проведення зіставних досліджень: Дослідження на матеріалі як споріднених, так і неспоріднених мов дозволяють виявити ґендерні асоціації у різних мовах. Це може включати порівняння лексики, граматики, стилістичних особливостей тощо.

Аналіз мовленнєвої поведінки: Дослідження письмової та усної форм мовлення чоловіків і жінок зосереджене на меті висловлювання, стратегіях та

тактиках. Це включає вивчення того, як чоловіки і жінки використовують мовні засоби для досягнення своїх комунікативних цілей.

Отже, дослідження полягає в тому, щоб показати, як мова відображає та відтворює ґендерні стереотипи, які існують у свідомості носіїв мови. Вони допомагають розкрити глибинні зв'язки між мовою і статтю, а також дослідити використання ґендерного компоненту у різних мовних жанрах, таких як прислів'я та приказки. Ці дослідження сприяють розвитку гендерології та поглибленню розуміння впливу ґендеру на мовленнєву поведінку та культурну комунікацію.

ЛІТЕРАТУРА

1. Горошко, Е. (2001). Гендерна проблематика в мовознавстві: введення в ґендерні дослідження. Харків: ХЦГИ. Ч. 1.
2. Дороніна, Т. (2005). Ґендерний напрямокв літературознавстві. Ґендерний розвиток у суспільстві (Конспекти лекцій) : Київ, ПЦ «Фоліант».
3. Космеда, Т. А., Карпенко, Н. А., Осіпова, Т. Ф (2014). Гендерна лінгвістика в Україні: історія, теоретичні засади, дискурсивна практика. колект. моногр. Харків : ХНПУ ім. Г. С. Сковороди; Дрогобич : Коло.
4. Шлєіна, Л. І. (2020). Критерії і показники сформованості гендерної культури у студентства аграрних закладів вищої освіти. *Науковий журнал «Інноваційна педагогіка». Одеса : Причорноморський науково-дослідний інститут економіки та інновацій*. Вип. 29. Том 2. С. 151–155.
5. Shlieina, L. I. (2020). Formation of gender culture of students of institutions of higher agricultural education: the essence and organizational and pedagogical conditions. *Humanitarian Balkan Research*. Plovdiv. T. 4. 3(9). P. 35–39.

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ІНФОРМАЦІЙНА БЕЗПЕКА ОСОБИСТОСТІ: СОЦІАЛЬНІ ТА ФІЛОСОФСЬКІ АСПЕКТИ В ГЛОБАЛЬНОМУ КОНТЕКСТІ

У сучасному цифровому суспільстві, де інформаційні технології проникають в усі сфери життя, питання про інформаційну безпеку особистості стає все більш актуальним і важливим. Інформація, якою обмінюються люди в онлайн-просторі, часто містить чутливі дані, включаючи персональну інформацію, фінансові відомості, медичну та комерційну інформацію. Однак, разом з можливістю миттєвого доступу до інформації та комунікації виникають і нові загрози, які можуть порушити безпеку особистості .

Крім технічних аспектів, інформаційна безпека особистості також має соціальні та філософські аспекти, які необхідно враховувати в глобальному контексті. Ці аспекти включають питання про етику поводження з особистими даними, права та свободи людини в цифрову епоху, а також роль держави та суспільства у захисті даних громадян.

Соціальні медіа можуть становити загрозу інформаційній безпеці через свою популярність, поширеність і характер взаємодії між користувачами. Зловмисники можуть створювати фальшиві профілі або сторінки на соціальних медіа, щоб проводити атаки фішингу, де вони можуть намагатися обдурити користувачів, отримати їх особисту інформацію або облікові дані. Соціальні медіа можуть використовуватися для розповсюдження шкідливих посилань або вмісту, який може містити віруси, шпигунські програми чи інші шкідливі програми, що становлять загрозу безпеці даних. [1, с.94].

Для зниження ризиків, пов'язаних з соціальними медіа, організації та користувачі можуть приймати ряд заходів, таких як навчання співробітників в

області безпеки інформації, використання засобів моніторингу та фільтрації контенту, регулярне оновлення паролів і обмеження доступу до чутливої інформації.

Навчання з безпеки інформації забезпечує користувачів навичками, необхідними для захисту своєї інформації та систем від кібератак. Це включає в себе навчання по створенню безпечних паролів, розпізнаванню фішингових атак, установці і оновленні антивірусного програмного забезпечення і т. п.

Також навчання допомагає користувачам і співробітникам зрозуміти важливість дотримання процедур безпеки в їх організації або особистому житті, що може включати в себе розуміння правил використання паролів, корпоративних ресурсів, процедур резервного копіювання даних. Чим більш обізнані користувачі про безпеку інформації, тим менше ймовірність того, що вони стануть жертвою кібератаки або зроблять помилку, яка призведе до витоку даних або інших проблем безпеки.

Навчання створює культуру безпеки, в якій захист інформації є пріоритетом для всіх учасників організації чи суспільства. Це може зробити середовище більш стійким до загроз інформаційній безпеці [2, с.88].

Розуміння психології користувачів є важливим аспектом у забезпеченні інформаційної безпеки. Знання того, як люди взаємодіють з технологіями допомагає розробляти більш ефективні методи захисту та навчати користувачів основам кібербезпеки.

У глобальному масштабі соціальні та філософські аспекти відіграють важливу роль у розвитку міжнародного співробітництва та довіри між країнами. Для ефективної боротьби з кіберзагрозами та захисту інформації необхідно враховувати і поважати відмінності в цінностях і культурних особливостях різних народів і суспільств.

Соціальні та філософські аспекти відіграють важливу роль у забезпеченні інформаційної безпеки в глобальному контексті, оскільки вони визначають

основні принципи, цінності та норми, що формують стратегії та політику в цій галузі.

ЛІТЕРАТУРА

1. Козлов, О.А., Поляков, В. П. (2020). Інформаційна безпека особистості: актуальні педагогічні аспекти. Київ, Наука.
2. Назарова, Ю.В., Аніщенко, О. С. (2019). Нова цифрова етика у віртуальному просторі: дилеми контролю та етичної експертизи. Харків, Проспект.

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DIGITAL TRANSFORMATION OF BUSINESS COMMUNICATION: A LOOK INTO THE FUTURE

In today's business world, communication plays a key role in building effective relationships both within organizations and with external partners. With the rapid advancement of technology and the shift to a digital age, we are witnessing a profound transformation of the methods, tools, and culture of business communication. From email to artificial intelligence, digital transformation is reshaping the way information is exchanged, decisions are made, and trust is built. The relevance of this topic stems from the fact that effective communication is the foundation for innovation, collaboration, adaptability, and competitiveness. Companies that can restructure their communication channels to meet new digital standards will gain a strategic advantage in times of constant uncertainty. The aim of this paper is to analyse how digital transformation is changing business communication today, and what it will look like in the near future.

According to a PwC study, 80% of executives consider digital communication channels critical to business success in the next five years [1]. Key technologies that are transforming communication include cloud services, video conferencing, artificial intelligence, chatbots, and corporate social networks. McKinsey reports that companies effectively integrating digital communication tools (such as Microsoft Teams, Slack, and Zoom) improve team productivity by 20–25% [2]. They emphasize that success depends not only on the tools themselves but also on a culture of transparency, fast feedback, and trust. According to Statista, the use of video communication for business purposes grew by 400% between 2019 and 2023, especially in the small and medium business segment [3]. Digital communication not only speeds up information exchange but also reduces costs related to logistics and travel. Deloitte experts point to risks associated with digital overload: information fatigue, loss of personal contact, and difficulty maintaining attention [4]. Therefore, the future lies in hybrid communication models that combine the flexibility of digital platforms with human empathy. Forbes analysts predict that communication based on artificial intelligence (AI) and behavioural analytics will become the standard in the next five years, especially in customer service [5]. For example, personalized chatbot responses are already replacing hundreds of contact centre agents.

As far as I am concerned, digital transformation of communication is more than just adopting new tools. It is a fundamental shift in the logic of interaction between people in business. We are already living in a world where instant feedback, video meetings from anywhere, and automated service have become the norm. I believe the main challenge is not to lose “humanity” in the digital transformation process. Digital communication should not only be fast and convenient but also ethical, inclusive, and trust-building. The future of business communication lies in balancing the efficiency of technology with the values of meaningful dialogue. Additionally, young professionals must develop “digital communication literacy” – the ability to conduct productive dialogues in online environments, use platforms effectively, and adapt their

communication style to digital formats. This will become one of the core competencies in the labour market.

In conclusion, digital transformation of business communication is an inevitable process that not only opens new development opportunities but also presents new challenges. Effective digital communication is not just about tools – it is about changing the culture, approaches, expectations, and even the language of interaction. Companies that can harmonize technology with human values will be the most competitive in the future. And those who learn to communicate effectively in digital environments will become the leaders of the next generation.

REFERENCES

1. PwC. (2022). 2022 Global Digital IQ Survey. URL: https://www.pwc.de/de/content/0f96ea9c-992c-4ba7-8c4d-b4637cf81d9f/pwc-digital-factory-transformation-survey-2022.pdf
2. McKinsey & Company. The social economy: Unlocking value and productivity through social technologies. URL: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights
3. Statista. Number of business video calls worldwide 2019–2023. URL: https://www.statista.com/statistics/1254884/mobile-video-calling-reach-by-region/
4. Deloitte. (2023). Human Capital Trends 2023. URL: https://www2.deloitte.com/us/en/insights/focus/human-capital-trends.html
5. Forbes. (2023). The Future of Communication in a Digital World. URL: https://www.forbes.com/sites/kwamechristian/2023/10/10/exploring-the-future-of-technology-communication--negotiation/

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ФІЛОСОФСЬКІ ПРОБЛЕМИ ШТУЧНОГО ІНТЕЛЕКТУ

Штучний інтелект (ШІ) – це поле, яке швидко розвивається і відкриває перспективи та можливості, які раніше вважалися фантастичними. Однак із

зростанням потужностей та можливостей ШІ виникають важливі філософські питання, які потребують обговорення та уважного аналізу.

Необхідно підкреслити, що однією з найбільш значних проблем є неухильний контроль людини і його розуму над штучним інтелектом.

Поява машин, що не піддаються людському управлінню, може істотно змінити етичні норми, далеко не в позитивну сторону. Кожна людина повинна усвідомлювати, що наявність свідомості у машини може привести до несподіваних і, найчастіше, несприятливих наслідків.

Це також торкнеться такого унікального людського феномену, як рефлексія. Також оцінка природи штучного інтелекту з точки зору права стала актуальним завданням для правотворчості.

Історія проблеми штучного інтелекту (ШІ) багато в чому відображає етапи технічного прогресу і зміни в наукових парадигмах:

- Наслідування зовнішній поведінці людини, його жестам і мотириці;
- Спроби відтворити мозок людини;
- Відтворення внутрішнього світу людини, його мислення і мови, емоцій.

На початку XX століття філософи і математики, такі як Алан Тьюринг, почали формулювати концепції, які лягли в основу обчислювальних машин. У 1950-х роках з'явилися перші програми, здатні грати в шахи і вирішувати математичні задачі, що сприяло оптимізму в розвитку ШІ. Однак у 1970-х і 1980-х роках настав “зимовий період” ШІ, коли очікування не виправдалися, і фінансування скоротилося.

У наступні роки, завдяки розвитку обчислювальних потужностей і алгоритмів машинного навчання, інтерес до ШІ відновився. У 2010-х роках різкий стрибок у обробці великих даних та прогрес у нейронних мережах, таких як глибоке навчання, призвів до значних проривів у розпізнаванні образів, обробці природних мов та автономних системах.

Еволюція становлення і розвитку людини унікальна і навряд чи повторювана. З точки зору філософії, пізнання і почуттів штучний інтелект

ніколи не зможе замінити людину. Штучний інтелект не володіє мудрістю, універсальними життєвими поглядами і не має власного духовного світу, ідеологічних переконань, ціннісних орієнтирів або ідеалів.

Його функціонування визначається людиною і здійснюється на основі простих принципів «так чи ні», «або-або», що робить його дії односторонніми і примітивними. Система штучного інтелекту, заснована на машинах і комп'ютерах, не в змозі розмірковувати, створювати реальність або передбачати майбутні події. У неї відсутні такі якості, як творче і рефлексивне мислення, критичний аналіз і самосвідомість.

ЛІТЕРАТУРА

1. Руссель, С. А, Норвіг, П. П. (2020). Штучний інтелект: сучасний підхід. Харків: “Вільямс”.
2. Боттін, Д. В, Куліков, А. В. (2021). Філософські та етичні аспекти штучного інтелекту. Київ: Наука.

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МЕТОДОЛОГІЧНІ СТРАТЕГІЇ РЕКОНСТРУКЦІЇ НОСТРАТИЧНОЇ ПРАМОВИ: СУЧАСНІ ВИКЛИКИ ТА ПЕРСПЕКТИВНІ НАПРЯМИ ДОСЛІДЖЕНЬ

Сучасна ностратична лінгвістика перебуває на етапі глибокого теоретико-методологічного оновлення. Попри те, що ідея про існування ностратичної

прамови була сформульована ще у першій половині XX століття (Ілліч-Світич, 1971–1984), актуальність досліджень у цій царині не зменшується. Навпаки, вона зростає в умовах інтенсивного розвитку когнітивної макрокомпаративістики (Дронова, 2019; Старостін, 2006–2013), що дозволяє розглядати прамови не лише як лінгвістичні абстракції, а як реконструйовані допрамовні структури, які відображають глибинні типологічні закономірності розвитку мов.

Одна з ключових стратегій сучасної ностратики – **діахронічна інтерпретація**. Це поняття, що охоплює реконструктивну діяльність, спрямовану на виявлення позиційних і комбінаторних збігів та зсувів у вокалізмі, консонантизмі, морфонології та семантиці (Климов, 1988; Капранов, 2021). Такий підхід ґрунтується на принципах масового споріднення мов, сформульованих у працях Greenberg (1963), Bomhard (1994), Старостіна (2006), і передбачає використання preprotolanguages – передпрамовних станів для глибшої верифікації етимонів.

На відміну від класичного порівняльно-історичного методу, що працює в межах однієї мовної сім'ї, макрокомпаративістика досліджує гіпотетичні взаємозв'язки між мовами різних сімей. У цьому контексті особливе значення має метод **квантитативної верифікації** – математичного й комп'ютерного аналізу фонологічних, морфонологічних і семантичних збігів. Цей метод дозволяє об'єктивно виміряти ступені спорідненості між мовами через формули Раушенбаха, Левенштейна, Соренсена (Капранов, 2021).

Предметом такого аналізу стають універсальні ностратичні етимони (*HuĶa 'око', *wol[a] 'великий', *wete 'вода', *phaħ- 'вогонь', *marV 'дерево'), які фіксують базові концепти ностратичної свідомості: "тіло – ознака – стихія" (Ілліч-Світич, 1971; Долгопольський, 2008). Їхнє зіставлення в межах семи мовних сімей (алтайської, афразійської, дравідійської, ескімосько-алеутської, індоєвропейської, картвельської, уральської) демонструє наявність як **близького**, так і **далекого** ступенів спорідненості (Bomhard & Kerns, 1994; Starostin, 2006).

Наразі розробляється **графоаналітична мережа**, що візуалізує дивергентно-конвергентні (ДК) і конвергентно-дивергентні (КД) траєкторії розвитку мов. Така мережа дозволяє дослідникам унаочнити складні взаємозв'язки між мовами та встановити зони тривіальних (близьких) і конвенціональних (віддалених) відношень (Капранов, 2021). Методологічна стратегія, що поєднує діахронічну інтерпретацію, квантитативну верифікацію та графоаналітику, створює новий підхід до систематизації ностратичних мов як макросім'ї.

Серед сучасних викликів – необхідність стандартизації термінології, уточнення статусу ностратичних мов щодо інших гіперсімей (індо-уральської, сино-кавказької, борейської тощо), а також інтеграція міждисциплінарних даних з археології, антропології, палеогенетики. У цьому напрямі активно працюють дослідники з Європи та США (Bomhard, 2018; Blažek, 2011).

Перспективним є застосування методів **штучного інтелекту й машинного навчання** для автоматичної реконструкції прамовних станів, створення комп'ютерних корпусів протоформ і обчислення фонологічних закономірностей. Це дозволить подолати обмеження суб'єктивної оцінки етимологічної відповідності та підвищити точність гіпотез.

Таким чином, методологічні стратегії реконструкції ностратичної прамови трансформуються у напрямку комплексного синтезу філологічного, математичного та цифрового аналізу. Саме на цьому перехресті можливе подальше просування до вирішення фундаментального питання – походження мови як універсального феномену.

ЛІТЕРАТУРА

1. Bomhard, A. R. (1994). *The Nostratic Macrofamily: A Study in Distant Linguistic Relationship*. Berlin: Mouton de Gruyter.
2. Bomhard, A. R. (2018). *A Comprehensive Introduction to Nostratic Comparative Linguistics with Special Reference to Indo-European*. Leiden: Brill.
3. Blažek, V. (2011). *On the Reconstruction of the Nostratic Phonological System*. Journal of Language Relationship, 6, 25–42.

4. Долгопольський, А. Б. (2008). *Nostratic Dictionary*. Москва: Восточная литература.
5. Иллич-Свитыч, В. М. (1971–1984). *Опыт сравнения ностратических языков*. Москва: Наука.
6. Капранов, Я. В. (2021). *Діахронічна інтерпретація і верифікація ступенів споріднення ностратичних мов*. Київ: КНЛУ.
7. Климов, Г. А. (1988). *Введение в сравнительное языкознание*. Москва: Наука.
8. Старостин, С. А., & Старостин, Г. С. (2006–2013). *Глобальная лексикостатистическая база данных "Вавилонская Башня"*. URL: http://starling.rinet.ru

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THE ROLE OF INTERCULTURAL COMMUNICATION IN LANGUAGE LEARNING

To begin with, mastering foreign languages fosters the development of cultural competence and global skills, contributing to both professional advancement and personal success in a multicultural society. The intercultural component of language education equips learners for communication with individuals from diverse cultural backgrounds and develops their ability to recognize, understand, and respect others as individuals who may hold different perspectives, values, and behaviors. In addition, intercultural communication encompasses a range of topics from linguistics and sociology to psychology and anthropology. It is considered to be a complex field that requires an understanding of various cultures, languages, psychologies. Appropriate intercultural communication can yield positive results for business operations, international negotiations and interpersonal interactions [1].

It should be noted that intercultural communication can be defined as the exchange of information on various levels of understanding between individuals of diverse cultural backgrounds. Effective communication with others necessitates a thorough understanding of cultural differences. Furthermore, culture plays a significant

role in determining how individuals from different nations and cultures interact, communicate, and interpret messages.

Effective intercultural communication relies on a range of skills, some of which can be taught, while others are innate and require refinement through practice. The following are among the most essential personal competencies for successful intercultural interaction:

Self-awareness: recognizing how your personal views, behaviors and stereotypes may affect a conversation is a huge step in improving your ability to have meaningful interactions with others.

Empathy: intercultural communication relies heavily on empathizing with others and gaining insight into their experiences.

Emotional intelligence: developing the ability to perceive the subtle nuances of communication is crucial when interacting with individuals from different cultural backgrounds. Successful interpretation of messages largely depends on sensory awareness, self-knowledge, and the capacity for empathy.

Adaptability: One of the goals of intercultural communication is to teach people how to modify their way of speaking to replace ambiguity, conflict, and antagonism with clarity, harmony, and cooperation [2].

Patience: effective communication across cultural boundaries requires time and cannot be achieved instantly. Therefore, patience is essential. Cultural differences may influence the pace at which new information is understood and internalized.

Positivity: maintaining an optimistic attitude when interacting with people of other cultures is crucial. Misunderstandings are common in intercultural communication and typically do not result from intentional ambiguity. It is pivotal to approach every intercultural interaction with a constructive and open-minded attitude.

In conclusion, in today's interconnected world, the ability to communicate across cultural boundaries is more important than ever. It facilitates communication across linguistic and cultural boundaries, leading to more tolerance, acceptance, and, ultimately, stronger relationships amongst people of diverse backgrounds.

REFERENCES

1. *European School Education Platform*. (n.d.) URL: https://school-education.ec.europa.eu/en/discover/news/intercultural-competence-role-language
2. *Language Schools blog*. (2025). Middlebury Language Schools. https://www.middlebury.edu/language-schools/blog/language-learning-why-intercultural-communication

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КОЧОВЕ МИНУЛЕ У ХУДОЖНЬОМУ ДИСКУРСІ: ЛІНГВОСТИЛІСТИЧНІ ЗАСОБИ РЕКОНСТРУКЦІЇ ІДЕНТИЧНОСТІ ТА ПРОСТОРУ

Вступ. У сучасному гуманітарному дискурсі спостерігається зростання зацікавлення міждисциплінарними підходами до аналізу мови й тексту. Одним із перспективних напрямів є залучення результатів археогенетичних досліджень, а також культурної антропології й теорії колективної пам’яті. З огляду на це актуалізується питання осмислення кочового минулого як культурного феномена, що знаходить своє відображення в художньому дискурсі.

1. Кочовий архетип у колективній мовній свідомості

Кочовий архетип постає як багатогранна смислова структура, яка спирається на уявлення про рухливість, несталість, відкритість до простору та динамічну ідентичність. У мовній картині світу він закріплений через образи дороги, степу, вітру, табору, тимчасового притулку, а також опозиції “осіле / рухоме”, “центр / периферія”, “власне / інше”.

Фігура кочівника у тексті виконує не лише наративну функцію, а й стає репрезентацією способу пізнання світу. З погляду стилістики, вона актуалізує словникові одиниці з підвищеним емоційним і символічним навантаженням. Такі

елементи в тексті утворюють семантичні вузли, що відтворюють уявлення про пам’ять, тілесність, територію, втрату і пошук.

2. Простір і рух як категорії художнього тексту

Простір у художньому тексті, що апелює до кочової моделі, набуває характеристик відкритості, зміщення, мобільності. Домінантною стає лексика, що фіксує просторові координати: степ, обрій, вітер, край, дорога, небо, табір. Ці слова часто виконують роль образних центрів, навколо яких розгортається сюжет або внутрішній конфлікт героя. Категорія руху реалізується за допомогою дієслів (рухатися, йти, кочувати, зникати) та через синтаксичні конструкції, що передають динаміку — короткі речення, анафори, переліки, інверсії. Наприклад:

Йшли. Без зупинок. У пилюці й тиші. Кінь важко дихав.

Тут синтаксис моделює ритм руху, а лексика створює ефект просторової невизначеності, притаманної кочовому світовідчуттю. Окрему роль відіграє топос дороги — символ переходу, трансформації, пошуку нової ідентичності. У художньому тексті він часто постає як елемент з глибоким екзистенційним змістом.

3. Ідентичність як текст

Ідентичність у художньому дискурсі, що репрезентує кочовий архетип, постає як змінна, нестала, така, що формується в умовах переміщення та взаємодії з “іншим”. Ця концепція втілюється через опозиції (своє / чуже, дім / шлях), алюзії на змішаність походження, риторичні питання, що свідчать про пошук себе.

Мовні засоби, які моделюють таку ідентичність, включають особові займенники, дієслова становлення й втрати, лексеми, що вказують на коріння, пам’ять, спадщину. Ідентичність постає як результат дискурсивних практик — вона не фіксується, а продукується в мовленні, змінюється, конфліктує сама з собою.

Висновки

Кочовий архетип у художньому дискурсі функціонує як стильова домінанта, що визначає особливості організації простору, руху та ідентичності. Через лінгвостилістичні засоби текст відтворює досвід переміщення, втрати, пошуку, гнучкого самовизначення.

Такий підхід дозволяє інтерпретувати художній текст як простір реконструкції пам'яті та культурної ідентичності, що відкриває нові можливості для лінгвістичного аналізу в умовах міждисциплінарного підходу.

ЛІТЕРАТУРА

1. Вінграновський, М. (2004). Вибране. К.: Веселка.
2. Шевчук, В. (2001). Дім на горі. К.: Либідь.
3. Мамалига, А. І. (1983). Структура газетного тексту. Київ.
4. Теремко, В. (2011). Психологічні виміри читання у видавничій стратегії. Львів.
5. Reich, D. (2018). Who We Are and How We Got Here. Oxford University Press.

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АКСІОЛОГІЯ СУЧАСНОЇ УКРАЇНСЬКОЇ ПОЕЗІЇ ПРО ВІЙНУ

Війна в Україні, яка розпочалась у 2014 р., змусила більшість людей переглянути свої пріоритети, обрати для себе життєво важливі цінності. Нагальні екзистенційні питання: еміграції чи життя в окупації, боротьби з ворогом чи прийняття ситуації, вибору подальшого життєвого шляху, коли все, що мав до того, знищено, – усі вирішуються тепер в залежності від аксіологічних орієнтирів кожної окремо взятої особистості.

Поезія найперше реагує на події сучасності та зміни у свідомості. Пізнаючи ціннісні установки, закладені авторами поетичних текстів про війну, ми можемо

робити висновки про внутрішні спонуки соціуму, його аксіологічну систему та коригувати суспільну думку задля підтримання єдності народу, досягнення миру й стабільності в державі. Тож розглядаємо аксіологію сучасної поезії про війну в Україні на матеріалі збірки Б. Томенчука «Вишийте, мамо, бронежилет».

Богдан Томенчук – відомий український поет з Івано-Франківська. Його поетичні збірки – спосіб боротьби митця проти зовнішнього ворога: вони підтримують бойовий дух воїнів; розкривають негативні аспекти реальності й ті виклики, що з ними стикається сучасний герой, захисник України; прагнуть достукатись до душ обивателів, їхньої честі й совісті. Таким чином, можна стверджувати, що поезія Б. Томенчука визначає ті цінності й базові принципи, якими має керуватись справжній українець у своїй життєдіяльності.

У виданні «Вишийте, мамо, бронежилет» зібрані вірші митця, написані в різні роки, але переважна більшість їх присвячені теперішній російсько-українській війні. Одним із провідних мотивів цієї збірки є любов до України, Батьківщини, за яку відбувається одвічна боротьба. Автор говорить про цей об’єкт сакралізації як прямо, так і опосередковано, використовуючи алюзії, метафори, образи-сенсоризми. Усі ці тропи загалом слугують створенню образу України, який закарбувався в душі ліричних героїв творів та супроводжує їх у житті, даючи душевну опору, фізичну силу й наснагу до боротьби з ворогом, і в смерті, оплакуючи їх, як Богородиця свого сина.

Автор віршів чітко визначив межі Добра і Зла й ту мету, якої український народ прагне досягти століттями, – свобода, незалежність, продовження свого існування (поезії «Я не став твоїм першим…», «Ви з Вітчизною в чомусь однакові…», «Болить мене десь між Дніпром і ребром…» та ін.). Лейтмотив України як сенсу життя і смерті, найвищої цінності реалізується митцем через алюзії до історичних подій та героїчних постатей (Гонти, Івана Мазепи, Степана Бандери тощо); спогади воїнів про рідний край за мить до їхньої загибелі; аналогії з божественним світом та біблійною легендою про розп’яття Христа. Таким чином, кількасотрічна боротьба українців за незалежність набуває

вселенського значення одвічного протистояння Добра і Зла, Бога й Люцифера. На думку автора, від результату цієї битви третього тисячоліття залежить доля не лише нашої нації, а й усього світу (вірші «Герої вмирають – давай без ілюзій…», «Цього разу у Господа інший сценарій…», «Не пропадемо, як Почайна…» тощо).

У такому сприйнятті реальності логічною видається й паралель між воїном, що загинув у бою за свій народ, за майбутнє України, та Ісусом Христом, який прийняв смерть за гріхи всього людства. Не випадково у віршах час від часу виринають образи хреста, розп'яття, Голгофи, однак біблійні топоси замінюються національними: Чумацький Шлях, Говерла, а не Голгофа, замість Богородиці – звичайна українська мати, яка втратила сина на війні, тощо. Таким чином, земні події наповнюються сакральним сенсом, набувають виняткового значення.

Готовність пожертвувати собою заради Батьківщини актуалізує ще одну цінність українського народу – честь. Ліричні герої творів визначають її для себе як вірність країні, щастя загинути в бою за добру справу, щоб не бачити, як постаті славетних предків «*стоять так докірливо перед очима*» («Пане Степане, від роду Бандеро…») (Томенчук, 2023).

Однак автор не зупиняється на поняттях вірності й совісті, яка не продається персонажами його поезій навіть сп'яну, – він вводить у вірші мотив помсти ворогам за знищення країни, розриті могили, смерть бойових побратимів тощо. Помста сакралізується, стає всеохопною, що простежується у творах «Ці вінки тернові, як віньєтки…», «Це наш аркан… Це наш останній танець…», «Тіні наших облич, світло наших імен», «Все… Миролюбство у минулім», «Як один постаємо супроти», «В ім'я Отця і Духа, й Сина…» та ін. Процес відплати постає як Божа воля, необхідна умова збереження й продовження життя на землі, де людей знищують через їхню приналежність до української національності («І настав білий світ, ніби чорна діра…»).

Лють, яку відчувають ліричні герої до ворога, та любов і відданість своїй країні – ті амбівалентні почуття, які визначають їхній екзистенційний вибір. У

більшості випадків він тримається на уявленнях про честь. Так, у вірші «Болить мене десь між Дніпром і ребром…» звучить алюзія на скрижалі, на яких було висічено десять заповідей Бога людству, які мали б скеровувати їх у земному житті та визначали морально-етичні принципи співіснування.

Отже, в поезії Б. Томенчука про війну вибудовується чітка ієрархія цінностей українця, які сповідує ліричний герой – захисник своєї країни. На вершині цієї ієрархії стоять Україна і Бог, тож боротьба за рідну землю постає богоугодною справою, а її учасники у протистоянні Добра і Зла однозначно показані представниками першої сили.

ЛІТЕРАТУРА

1. Томенчук Б. (2023) Вишийте, мамо, бронежилет : поезія. Брустури : Дискурсус.

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АНТИЯДЕРНИЙ РУХ В УКРАЇНІ В 1985 - 1991 РР..

Атомна енергетика України бере свій початок з вересня 1977 р., коли було введено в експлуатацію перший енергоблок Чорнобильської АЕС. Зростаюча потреба в електроенергії сприяла подальшому швидкому будівництву атомних електростанцій. «Мирний атом» здавалося був безмежним джерелом енергії. Однак все змінила аварія на 4-му енергоблоці Чорнобильської АЕС, що відбулася 26 квітня 1986 року. Всього в Україні радіоактивного забруднення зазнали величезні території площею понад 50 тисяч квадратних кілометрів у 72 районах 12 областей. В цілому, по Україні потерпілих від Чорнобильської катастрофи нараховується понад 3,2 мільйона чоловік [4, С. 4].

Аварія на ЧАЕС змінила ставлення українців до «мирного атома». В Радянському Союзі виникає громадська опозиція діяльності ядерно-енергетичної галузі у формі екологічних неурядових товариств. Першою заявила про себе асоціація «Зелений світ», що з'явилась у грудні 1987 р..

Жахливі наслідки аварії на ЧАЕС та існування великої кількості осіб, що постраждали від радіаційного випромінювання, зумовили створення низки чорнобильських товариств в Україні. Найчисельнішою стала Всеукраїнська громадська організація «Союз Чорнобиль України» (СЧУ), установча конференція якої відбулася в травні 1989 р. [1, С.103].

Особливого загострення питання енергоатомної безпеки набуло в регіонах, на території яких розташовувалися АЕС або, що перебували у безпосередній близькості від них. В Миколаївській області на початку 1988 р. виникає антиядерний рух, мета якого полягала у боротьбі за припиненні нарощування потужностей Южно-Української АЕС за рахунок будівництва нових енергоблоків і супутніх об'єктів.

Дієвим заходом впливу на владу було використання мітингів та акцій протесту із залученням широких верств населення. 10 вересня 1988 року в Миколаєві пройшов мітинг проти затоплення унікального екологічного району під час будівництва Южно-Української АЕС. Мітинг протесту проти будівництва Костянтинівського водосховища, організований екологічною асоціацією «Зелений світ», відбувся на початку жовтня 1988 р. на березі Південного Бугу біля скелі Пугач [2, С. 165-173].

Значну протестну активність розгорнули громадські організації в Хмельницькій та Рівненській областях. Дослідження громадської думки, проведені в жовтні 1990 року визначили, що лише 6% населення у Хмельницькій області підтримували будівництво АЕС, і 19% висловлювалися за продовження їх експлуатації. Противниками продовження експлуатації виявилися 30% населення і 52% були проти будівництва нових об'єктів АЕС.

Показовими також стали результати соціологічного дослідження, метою якого було з'ясування ставлення мешканців м. Енергодар до Запорізької АЕС. Більшість респондентів (66%) висловила думку, що недостатня інформація про роботу АЕС формує негативне ставлення до них. Тільки 18% схильні були довіряти повідомленням у засобах масової інформації про ситуацію на АЕС і 45% опитуваних висловилися за продовження роботи АЕС.

Для Криму проблема екологічної безпеки особливого загострення набула через початок будівництва Кримської АЕС. Перші системні ознаки суспільної активності противників атомної станції проявились навесні 1988 р., коли в Сімферопольському державному університеті ім. Фрунзе відбулися публічні дискусії, під час яких досить гостро стало питання про доцільність будівництва АЕС в Криму.

Відбувається консолідація суспільства навколо енергоатомної безпеки і виникає Кримська асоціація «Екологія і світ». Організація набула широкої популярності серед населення багатьох міст Криму: Сімферополя, Керчі, Феодосії тощо. Слід відзначити, що Крим для багатьох радянських людей асоціювався виключно з рекреаційною зоною для оздоровлення дітей та дорослих. Дану тезу було успішно використано у відомому мітингу організації «Екологія і світ», що відбувся 24 вересня 1989 р. в смт Леніне [3, С. 198-206].

Отже, за широкої підтримки населення, в Радянському Союзі виникає громадська опозиція функціонуванню ядерно-енергетичної галузі у формі неурядових товариств. Питаннями радіаційної безпеки та супутніх проблем, пов'язаних з функціонуванням атомних об'єктів, займалися екологічні організації: асоціація «Зелений світ», Кримська асоціація «Екологія і світ», «Союз Чорнобиль України» тощо. Неурядові товариства, що розгорнули антиядерний рух зробили вагомий внесок у запровадження мораторію на будівництво нових атомних електростанцій та на збільшення потужностей діючих АЕС на території України, який в серпні 1990 р. ухвалила Верховна Рада УРСР.

ЛІТЕРАТУРА

1. Касараба, Ю. Я., Омельченко, О. В. (2011). Громадські чорнобильські організації в країнах СНД і Балтії: організаційно-правові основи створення та напрями діяльності. *Науковий вісник Ужгородського університету. Серія Право*. Вип. 16.
2. Михайлов, В.В. (2012). Неформальний громадсько-політичний рух на Миколаївщині напр. 80-х – поч. 90-х років XX ст.. *Наукові праці історичного факультету Запорізького національного університету.* Запоріжжя. Вип. 33.
3. Михайлов, В.В. (2011). Український опозиційний рух і влада в Криму наприкінці 80-х – початку 90-х років XX ст.. *Наукові праці історичного факультету Запорізького національного університету*. Запоріжжя. Вип. 31.
4. Чорнобиль: десять років подолання. За матеріалами Мінчорнобиля України (1996). За заг. ред В. Холоти. Київ: Чорнобиль-інтерінформ.

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МОВА ШЛЮБНИХ ОГОЛОШЕНЬ

У сучасній лінгвістиці активно розвиваються жанрові концепції, що пов’язані з організацією міжкультурної взаємодії представників різних етнолінгвокультур. Це сприяє глибшому розумінню жанрової специфіки та суперечливої єдності міжмовних процесів. Особливу увагу привертає дослідження рекламної комунікації, зокрема шлюбних оголошень, які функціонують як універсальний мовленнєвий жанр у масовій комунікації представників різних національностей.

Шлюбні оголошення, як різновид рекламного дискурсу, мають специфічні жанрові особливості та комунікативні стратегії. Їх аналіз дозволяє виявити мовні засоби, що використовуються для досягнення комунікативних цілей, а також розкрити соціокультурні аспекти інтерпретації концептів «чоловік» і «жінка» у різних лінгвокультурних просторах.

Наукове вивчення шлюбних оголошень розпочалося за кордоном ще в XIX столітті, тоді як вітчизняні лінгвісти звернулися до цієї теми відносно недавно. Дослідження в цій галузі охоплюють аналіз комунікативної мети, жанрових особливостей та тактик адресанта, а також гендерні аспекти та жанрові характеристики інтернет-оголошень. [1]

Таким чином, шлюбні оголошення виступають як важливий об'єкт лінгвістичного дослідження, що дозволяє глибше зрозуміти механізми міжкультурної комунікації та жанрову специфіку рекламного дискурсу.

У сучасній лінгвістиці шлюбні оголошення розглядаються як специфічний мовленнєвий жанр, що поєднує інформативність із лаконічністю, передаючи максимум змісту за мінімумом лексичних засобів. Попри наявність деяких досліджень, питання статусу, змістового наповнення та лінгвокультурних особливостей шлюбних оголошень у сучасному українському мовознавстві залишається недостатньо опрацьованим.

Однією з головних проблем є визначення жанрової природи шлюбних оголошень та їхнього місця в системі мовленнєвих жанрів. Це зумовлено їхньою синтетичною природою, гібридністю та обмеженим теоретичним і термінологічним вивченням. [4]

Аналіз шлюбних оголошень у прагматичному аспекті дозволяє виявити специфічні способи мовленнєвого впливу на адресата, а також основні параметри комунікативної ситуації та можливості мовленнєвої дії. Оскільки шлюбні оголошення функціонують у сфері як чоловічої, так і жіночої комунікації, їх аналіз дозволяє виявити гендерні особливості та стереотипи мовлення.

Дослідження шлюбних оголошень на матеріалі неблизькоспоріднених мов здатне продемонструвати особливості певних лінгвокультур. Таким чином, шлюбне оголошення знаходиться на перетині різних лінгвістичних напрямків, що підтверджує необхідність його дослідження з різних точок зору.

Інтегральна парадигма дослідження передбачає включення дискурсивного, прагматичного, мовного та жанрового аспектів вивчення текстів шлюбних оголошень, що визначає актуальність даного дослідження.

На думку Ф. С. Бацевича, мовленнєві жанри являють собою відносно стабільні тематичні, композиційні та стилістичні типи висловлень, які, хоча й не є самими висловленнями, слугують типовими формами для індивідуального мовлення. Це розуміння є ключовим у його концепції лінгвістичної генології.

Науковець підкреслює, що людина спілкується, використовуючи конкретні мовленнєві жанри, часто не усвідомлюючи цього. Навіть у найвільнішій бесіді мовлення набуває певної жанрової форми - від шаблонної до гнучкої та творчої. Ці жанри засвоюються нами подібно до рідної мови, ще до теоретичного вивчення граматики.

Основними ознаками мовленнєвих жанрів Бахтін вважає:

- формально-композиційну та смислову цілісність;
- стильове оформлення;
- фіксованість у свідомості носіїв мови;
- певний обсяг;
- експресію та експресивну інтонацію;
- концепцію адресата й нададресата;
- відповідність типовим темам міжособистісного спілкування. [5]

Жанрова тональність, є важливою характеристикою мовленнєвого жанру. Вона включає емоційно-стильовий формат спілкування, що виникає в процесі взаємовпливу комунікантів і визначає їхні інтенції та вибір засобів спілкування. Тональність забезпечує єдність інтерпретації та сприйняття тексту. [1]

Таким чином, мовленнєві жанри організовують наше мовлення подібно до граматичних форм, і їхнє існування є необхідною умовою для ефективного мовленнєвого спілкування.

У сучасному мовознавстві мовленнєві жанри класифікуються за різними критеріями: усні та писемні, фатичні та інформативні, жанри та жанроїди, а

також педагогічні, наукові, політичні, релігійні, медичні, побутові тощо. Дослідники виділяють елементарні й комплексні жанри. Так, М. Федосюк відносить до елементарних жанрів привітання, повідомлення, похвалу - тобто висловлення, які корелюють із мовленнєвими актами. У його класифікації комплексні жанри представлені як монологічні та діалогічні типи текстів. [6]

Т. Шмельова розмежовує мовленнєві жанри на одноактні та багатоактні, тоді як К. Сєдов пропонує ієрархічну модель жанрових форм - від субжанрів, співвідносних із окремими мовленнєвими актами, до гіпержанрів, які охоплюють кілька жанрових одиниць. [7]

Таким чином, науковці продовжують осмислювати й розвивати інтенсивне формування лінгвогенологічних концепцій що засвідчує незгасаючий інтерес до вивчення мовленнєвих жанрів у межах сучасного мовознавства.

ЛІТЕРАТУРА

1. Бацевич, Ф.С. (2005). Мовленнєвий жанр у дискурсі: проблеми виділення і комунікативного аналізу. *Мовознавство*. 2. 41-506.

2. Бацевич, Ф. С. (2007). Словник термінів міжкультурної комунікації. Київ : Довіра.

3. Бацевич, Ф.С. (2006). Вступ до лінгвістичної генології. Київ : Академія.

4. Селіванова, О. О. (2010). Лінгвістична енциклопедія. Полтава : Довкілля Київ.

5. Велика, І. О., Бондаренко, Н. Б. (2017). Мовна особистість адресанта в контексті віртуального шлюбного дискурсу (на матеріалі німецької мови). Нова філологія, (69), 20-26. вилучено із http://novafilolohiia.zp.ua/index.php/new-philology/article/view/26

6. Войцешук, Л.А. (2006). Дискурс, мовленнєвий жанр та мовленнєвий акт як категорія організації мовного коду в комунікації. Актуальні проблеми сучасної філології. Мовознавчі студії: Зб. наук. Праць РДГУ. Вип. XIV. Рівне. 79-81.

7. Гомотюк, О.Є., Біловус, Л.І., Яблонська, Н.М., Васильків, О.В. (2021). Блог як мовленнєвий жанр – еволюція епістолярного жанру. *Вісник Харківського національного університету імені В. Н. Каразіна. Серія «Соціальні комунікації».* 17.

8. Шмелева, Т. В. (1995). Речевой жанр : Опыт общефилологического осмысления. Collegium. Киев, 1–2. 57–65.

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CHALLENGES AND PROSPECTS OF DEVELOPING ACADEMIC WRITING IN ENGLISH FOR STUDENTS OF NON-LANGUAGE SPECIALTIES

Academic writing is a crucial skill for success in higher education, particularly in English-speaking contexts. However, students in non-language disciplines often face unique challenges in developing these skills. The objective of this paper is to identify these challenges and highlight potential strategies for overcoming them.

Many students struggle with the nuances of academic English, including vocabulary, grammar, and structure [9]. For instance, engineering or business students may lack the exposure to the formal tone and discipline-specific terminology required for academic papers. Tools such as Grammarly and Hemingway Editor provide real-time language feedback and are commonly used by students to improve clarity and correctness in writing [6, 7].

Different academic fields have distinct writing conventions, which can confuse students unfamiliar with their discipline's expectations [15]. For example, while lab reports in biology emphasize brevity and passive voice, essays in sociology favor argumentation and critical discussion. Resources like The University of Manchester's Academic Phrasebank provide discipline-specific language patterns, helping students adapt their writing accordingly [17].

Balancing content mastery and writing skills can overwhelm students, leading to a decline in writing quality [5]. In STEM programs, students often prioritize technical knowledge over writing clarity. A study from MIT OpenCourseWare demonstrated that integrating writing assignments into core courses, such as thermodynamics or computer science, can help students develop writing skills without sacrificing content knowledge [11].

Students in non-language programs typically receive minimal formal instruction in writing. For instance, in a survey of business undergraduates in Eastern Europe, over 60% reported never having received academic writing instruction in English [13]. Universities can address this by providing access to writing centers or offering short modules through platforms like FutureLearn and edX, which provide free writing courses for STEM and business students [3, 4].

Embedding academic writing components into existing courses helps students practice writing in a meaningful context [10]. For example, The University of Hong Kong's "Writing Across the Curriculum" initiative has successfully introduced writing activities in non-language subjects such as economics and public health [8].

Collaborative writing and peer feedback are essential strategies for academic growth. Online platforms such as Google Docs and Peergrade enable real-time collaboration and structured peer review, which enhances critical thinking and self-assessment [1]. A case study from the University of British Columbia demonstrated a 30% improvement in writing quality among engineering students who used peer review tools in capstone projects [16].

Digital platforms such as Purdue OWL offer extensive guidance on citation styles, grammar, and writing structure, especially beneficial to students without direct access to writing support [14]. AI-driven platforms like Write & Improve by Cambridge English provide feedback based on CEFR levels, helping non-native English speakers track progress over time [2].

Educators in non-language disciplines may lack the training to support students' academic writing. Institutions like The WAC Clearinghouse (Writing Across the Curriculum) offer open-access resources and professional development materials for instructors seeking to integrate writing into subject-specific teaching [18].

In conclusion, the development of academic writing skills in English for students of non-language specialties is fraught with challenges but also presents numerous opportunities for growth and improvement. By adopting integrated teaching strategies, leveraging technology, and fostering a supportive learning environment, educational

institutions can significantly enhance students' writing competencies and academic success.

REFERENCES

1. Boud, D., & Feletti, G. (1999). The challenge of problem-based learning (2nd ed.). Kogan Page.
2. Cambridge English. (n.d.). Write & Improve. Retrieved from https://writeandimprove.com
3. edX. (n.d.). Academic English: Writing Specialization. Retrieved from https://www.edx.org
4. FutureLearn. (n.d.). English for Academic Study. Retrieved from https://www.futurelearn.com
5. Graham, S., & Perin, D. (2007). Writing next: Effective strategies to improve writing of adolescents in middle and high schools. Alliance for Excellent Education. https://www.carnegie.org
6. Grammarly. (n.d.). Grammarly: Free Writing Assistant. Retrieved from https://www.grammarly.com
7. Hemingway App. (n.d.). Hemingway Editor. Retrieved from https://hemingwayapp.com
8. HKU Teaching and Learning. (n.d.). Writing Across the Curriculum. The University of Hong Kong. Retrieved from https://tl.hku.hk
9. Hyland, K. (2006). English for academic purposes: An advanced resource book. Routledge.
10. McCarthy, L. P. (2010). A stranger in strange lands: A college student writing across the curriculum. In Lunsford, A. A., & Horner, B. (Eds.), Writing across languages and cultures (pp. 107–129). Longman.
11. MIT OpenCourseWare. (n.d.). Writing-intensive courses. Retrieved from https://ocw.mit.edu
12. Peergrade. (n.d.). Peer review made easy. Retrieved from https://www.peergrade.io
13. Pérez, A. (2019). Integrating academic writing in content courses: A Central European perspective. Journal of English for Academic Purposes, 40, 100782. https://doi.org/10.1016/j.jeap.2019.100782
14. Purdue OWL. (2023). Online Writing Lab. Purdue University. https://owl.purdue.edu
15. Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills (3rd ed.). University of Michigan Press.
16. UBC CTLT. (2022). Improving writing through peer review in engineering education. University of British Columbia Centre for Teaching, Learning and Technology. https://ctlt.ubc.ca
17. University of Manchester. (n.d.). Academic Phrasebank. Retrieved from https://www.phrasebank.manchester.ac.uk
18. WAC Clearinghouse. (n.d.). The WAC Clearinghouse: Writing Across the Curriculum Resources. Retrieved from https://wac.colostate.edu

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CROSS-CULTURAL COMMUNICATIONS AND HUMANITIES IN THE INFORMATION REVOLUTION ERA

The information revolution has significantly transformed the way cultures interact and communicate, making cross-cultural communication more crucial than ever. This paper explores the intersection of cross-cultural communication and humanities in the era of rapid technological advancement, analyzing how digital platforms have reshaped cultural exchanges, understanding, and expression.

Cross-cultural communication refers to the interaction between individuals from different cultural backgrounds. In the context of the information revolution, technological advancements such as the internet, social media, and mobile communication have facilitated unprecedented levels of interaction across diverse cultures. This section discusses the key elements that define cross-cultural communication today.

Digital tools have enabled instantaneous communication, breaking geographical barriers and allowing for real-time dialogue among disparate cultural groups. Platforms such as Zoom, Microsoft Teams, and Slack have become essential in fostering understanding and collaboration [13].

Moreover, platforms like InterNations connect expatriates and locals in cities around the world, facilitating cultural exchange through networking events and online communities [7].

Despite the benefits, technology can also exacerbate cultural misunderstandings. For example, research by the Pew Research Center shows that misinterpretations in digital communication often arise from differences in humor, politeness norms, and body language representation through emojis [9].

A practical case is the use of the “thumbs up” emoji 👍, which can be seen as positive in Western cultures but interpreted as offensive in some Middle Eastern and West African contexts [5].

The internet has allowed for the proliferation of various cultural identities, enabling individuals to express themselves and their heritage on global platforms. Initiatives like #BlackLivesMatter not only highlight racial injustice but also promote African American culture, history, and identity on a global scale through digital storytelling [3].

Conversely, controversies such as the debate around “cultural appropriation” in fashion, where brands like Gucci and Victoria’s Secret have been criticized for misusing cultural symbols, demonstrate the fine line between appreciation and appropriation [10].

The humanities encompass disciplines that study human society and culture, including literature, philosophy, history, and the arts. They play a crucial role in understanding and enhancing cross-cultural communication in several ways:

Humanities education fosters cultural literacy, equipping individuals with the knowledge and skills to navigate complex cultural landscapes. For example, platforms like Coursera offer courses such as “Intercultural Communication” from the University of California, Irvine, which enhance cultural understanding [4].

The study of humanities encourages critical thinking, enabling individuals to analyze and interpret cultural texts and media critically. Tools like Media Bias/Fact Check assist individuals in evaluating the cultural biases present in news sources and digital content [8].

The humanities also emphasize ethics in communication. Initiatives such as Stop AAPI Hate, created in reaction to growing anti-Asian attitudes during the COVID-19 pandemic, highlight the moral duty of digital users to interact respectfully with people from diverse cultures [11].

The Arab Spring is a notable example of how social media can facilitate cross-cultural communication and mobilization. Platforms like Twitter and Facebook were

pivotal in organizing protests and disseminating information across national and cultural boundaries [6].

Digital platforms like Bandcamp and Behance allow artists from diverse cultural backgrounds to showcase and sell their work globally. However, controversies around AI-generated art and questions of ownership highlight new challenges regarding cultural representation and intellectual property [12].

In conclusion, the information revolution has transformed cross-cultural communication, making it more accessible while also presenting challenges that require careful navigation. The humanities provide essential insights that can enhance understanding and foster more respectful and effective cultural exchanges. As we continue to engage in a digitally connected world, the integration of cross-cultural communication and humanities will be vital in promoting a more inclusive and understanding global society.

REFERENCES

1. Bandcamp. (n.d.). “Bandcamp”. Retrieved from https://bandcamp.com
2. Behance. (n.d.). “Behance”. Retrieved from https://www.behance.net
3. Black Lives Matter Global Network Foundation. (n.d.). “About”. Retrieved from https://blacklivesmatter.com
4. Coursera. (n.d.). “Intercultural Communication - University of California, Irvine”. Retrieved from https://www.coursera.org/learn/intercultural-communication
5. Holland, O. (2022, February 16). What your emojis really mean. “BBC Future”. https://www.bbc.com/future/article/20220216-what-your-emojis-really-mean
6. Howard, P. N., Duffy, A., Freelon, D., Hussain, M., Mari, W., & Maziad, M. (2011). Opening closed regimes: What was the role of social media during the Arab Spring? “Project on Information Technology and Political Islam”. https://www.researchgate.net/publication/228124644
7. InterNations. (n.d.). “Connect with expats worldwide”. Retrieved from https://www.internations.org
8. Media Bias/Fact Check. (n.d.). “Media Bias/Fact Check”. Retrieved from https://mediabiasfactcheck.com
9. Pew Research Center. (2021). “Cultural differences in online communication”. https://www.pewresearch.org
10. Safronova, V. (2021, February 18). Cultural appropriation and the fashion industry: Where do we draw the line? “The Guardian”. https://www.theguardian.com
11. Stop AAPI Hate. (n.d.). “Stop AAPI Hate”. Retrieved from https://stopaapihate.org
12. Vincent, J. (2023, March 1). The messy ethics of AI art. “Wired”. https://www.wired.com/story/ai-art-ethics/
13. Zoom Video Communications. (2024). “Zoom”. Retrieved from https://zoom.us

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COMMUNICATION AS A CRUCIAL TRANSFERABLE SKILL FOR GLOBAL COMMUNITIES

Communication is considered to be a crucial skill that helps to be successful in various areas. Undoubtedly, thanks to the common ground, people from ancient times managed to build cities, castles and other sites, developed in a lot of sciences and evolved gaining experience while connecting with other people throughout their life. To put it another way, a lot of people from different parts of the earth know how to talk to each other and use this skill on a daily basis. But quite often humans are annoyed and vexed so that they do not get the desired result from the conversation. The aim of this research is to highlight the key points that can help improve communication skills due to their significance to human progress.

According to C. Headlee [2], first of all, you need to listen more than you speak. The partner appreciates when you may listen carefully and not interrupt him or her. This point can show that you are a tolerator and cherish the opinion of the interlocutor. Also, you need to be engaged and interested in his or her speech. It is really critical for the speaker, e.g. you may ask him or her questions that can show your involvement.

Another crucial dimension is not to pontificate [2]. There are a lot of situations when people start sharing unnecessary information which is not relevant to the case, then the conversation can become boring for the listener. Therefore, we have to try to communicate in essence and stick to the point. Our speech should be succinct so as not to take up much time from the interlocutor.

The next aspect is “stay out of the weeds” [2]. You need to recognize that frequently people do not care about the details, so it is necessary to leave them out. It is equally important to incorporate that all experiences are individual. For instance, if

they are talking about having lost a family member, it is worth avoiding talking about the time you lost a family member. You must realize that it is not the same. At this moment, the person is opening his or her mind to share their stories or something else. It is not about you – it is about your partner.

Indeed, all the dimensions that have already been mentioned foster achieving success in communication. Meanwhile, there is one more crucial aspect which is critical for effective communication – trust. **Trust is a fundamental force that helps hold society together.** Every form of social interaction, whether implicit or explicit, involves trust to some extent. By its nature, trust is an emergent property, meaning it arises from interactions between two or more parties: the one who trusts and the one being trusted. Often, this relationship is mutual [3, 5]. According to Frei F. and Morriss A., it consists of three main components, namely authenticity, logic and empathy, making up the Trust Triangle [1].

As to authenticity, it is a truly crucial factor of trust. Admittedly, people often pretend to be different in order to make a cool impression. They dissemble to be ambitious, insightful, eloquent and generally successful. People like to exaggerate to create a false but at the same time flawless impression of them. On the one hand, it can bring success in the short term. On the other hand, you have to lie and hide yourself behind a mask, and this can have harmful consequences in the long run, because when a person hides something, their mental health deteriorates as he or she is very nervous and anxious. It is suggested that people should be genuine and transparent in conversations. Surely, it demonstrates the confidence of the interlocutor.

The next point is logic, and it is about having a clear, sound, and transparent thinking process. People are more likely to trust someone when they understand the reasoning behind their decisions and actions. If there is a lack of clarity or if the logic seems faulty, trust can be undermined. Building trust is necessary to being straightforward, backing up arguments with evidence, and ensuring that others can easily follow the logic.

The last component of the Trust Triangle is empathy. It is crucial for building trust because it demonstrates genuine concern for the needs and feelings of others. To put it in a nutshell, you need to use your emotional intelligence. First of all, it is a very essential skill for effective communication. Nowadays, knowledge alone is not enough, you should be able to empathize or share the joy with the partner in order to build up a great relationship. Also, you need to give others your undivided attention, be present in the conversation and acknowledge their points of view. This approach makes people feel valued, builds trust, and shows that their experiences and problems are of a great importance to us.

To sum up, being a good communicator involves more than just speaking clearly as it requires active listening, engagement, and genuine respect for the other person's perspective. By avoiding unnecessary details and staying concise we make interactions meaningful and effective. Trust plays a very important role that can be divided into three dimensions: authenticity, logic and empathy. When we show our real selves, communicate logically, and connect empathetically, we foster a sense of understanding and respect. This approach not only enhances communication, but also builds lasting relationships based on trust and respect. Anyway, we need to take into account that all people are different and their communication skills can be different from ours. Sometimes we can face some barriers in communication [3], but if we incorporate all the above-mentioned tips, we could turn communication round.

REFERENCES

1. Frei F., Morriss A. (2020). Begin with Trust – The first step to becoming a genuinely empowering leader. URL: https://hbr.org/2020/05/begin-with-trust.
2. Hedlee C. 10 Effective Ways to Improve Your Conversation Skills. URL: https://ed.ted.com/lessons/10-ways-to-have-a-better-conversation-celeste-headlee
3. *Hobbes T. (1651). Leviathan. Cambridge, UK: Cambridge University Press*, Delhi. URL: https://www.frontiersin.org/
4. Lunenburg F.C. (2010). Communication: The Process, Barriers, and Improving Effectiveness. Schooling. Vol. 1, no. 1.
5. Redfern A. (2009). Thomas Hobbes and the Limits of Democracy. Ispck: Cambridge Press, Delhi. URL: https://www.frontiersin.org/

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КОМУНІКАЦІЯ ЯК ПРОЦЕС: ОБ'ЄДНАННЯ РІЗНИХ АСПЕКТІВ ВЗАЄМОДІЇ

Спілкування - це складний і багатогранний процес встановлення та розвитку контактів між людьми, обумовлений потребою у спільній діяльності. Він охоплює обмін інформацією, формування спільної стратегії взаємодії, а також сприйняття та розуміння іншої особи.

Психологічна наука базується на принципі нерозривної єдності спілкування та діяльності. У процесі спілкування психологія виділяє такі аспекти: комунікативний, інтерактивний, перцептивний, фатичний.

Комунікативний аспект спілкування стосується специфіки інформаційного обміну між людьми як активними суб'єктами, з урахуванням їхніх взаємин, установок, цілей та намірів. Це призводить не лише до передачі інформації (прямої та зворотної), але й до уточнення та збагачення знань, відомостей і думок, якими обмінюються люди.

Засобами комунікативного процесу є різні знакові системи, передусім мова, а також оптико-кінетична система знаків (жести, міміка, пантоміміка), пара- та екстралінгвістичні системи (інтонація, немовні вставки в мову, наприклад, паузи), система організації простору та часу комунікації, а також система "контакту очима".

Важливою характеристикою комунікативного процесу є прагнення його учасників вплинути один на одного, на поведінку іншої особи, забезпечити свою ідеальну представленість, а для іншого - персоналізацію. Необхідною умовою цього є не лише використання спільної мови, але й однакове розуміння ситуації спілкування.

Інтерактивна складова спілкування полягає в розробці загальної стратегії взаємодії. Згідно з інтеракціоністичним підходом, дослідники вивчали здатність людини до спілкування через призму її «стильової» взаємодії з навколишнім середовищем: індивідуальний комунікативний стиль як сукупність психологічних прийомів і методів діяльності, які визначають способи (позиції) і ефективність гностичної та інтерактивної частин спілкування (О. Я. Андрос, О. В. Безгіна, Є. І. Маствіліскер, В. М. Куніцина, В. С. Мерлін, Л. О. Южанінова, Т. Олпорт та ін.), а також у контексті трансакційного аналізу (Е. Берн, Т. Харріс). Виокремлюються різні типи взаємодії між людьми, зокрема кооперація і конкуренція. Однак абстрактне трактування цих типів як «згоди» чи «конфлікту» веде до спрощеного опису процесу. Хоча досягнуті значні результати, зокрема у вигляді прогнозування стратегій поведінки партнера за допомогою елементів математичної теорії ігор, формальність такого підходу та обмеження дослідження лише взаємодією двох осіб ускладнюють застосування цих даних у реальному житті, де взаємодіють різні люди. Для психології властивий детальний аналіз різних типів взаємодії, що розглядаються як способи об'єднання індивідуальних зусиль у конкретних формах спільної діяльності.

Перцептивна сторона спілкування включає процес формування образу іншої людини через «читання» її фізичних характеристик, що дозволяє зрозуміти особливості її психіки та поведінки. Основними механізмами пізнання іншої особи є ідентифікація (уподібнення) і рефлексія (усвідомлення того, як інші сприймають суб'єкта пізнання). У процесі міжособистісного сприйняття й пізнання можна виділити низку перцептивних феноменів, зокрема: а) «ефект» первинності, б) «ефект» новизни, в) «ефект» ореолу. Важливу роль також відіграють стереотипізація та каузальна атрибуція.

Розуміння цих механізмів дозволяє виявити психологічний зміст взаєморозуміння, яке досягається в процесі спілкування. Зв'язок між спілкуванням і певним типом відносин між людьми також проявляється в емоційній регуляції перцептивного процесу, зокрема у феноменах атракції та

тяжіння. Комплексний аналіз спілкування, його аспектів та функцій в їхній єдності є важливою умовою для оптимізації спільної діяльності людей і їхніх взаємин. Однією з основних завдань психології є розробка методів коригування та оптимізації спілкування, розвитку комунікативних навичок, особливо у навчальному контексті, що набувають значення як форма культури для людей, професійно пов'язаних зі спілкуванням (керівників, викладачів, медичних працівників тощо).

Фатична сторона комунікації (від лат. fatuus - дурний) є особливою і зосереджена на використанні комунікаційних засобів виключно для підтримки процесу спілкування. Така форма спілкування є позбавленою змісту і нагадує безглузді балачки: люди обмінюються безсенсними фразами, нісенітницями, просто ведуть розмови про неважливі та несерйозні речі.

Серед методів навчання мистецтву спілкування важливу роль відіграє соціально-психологічний тренінг, який передбачає освоєння різних форм спілкування через вирішення спеціально розроблених завдань.

Спілкування є складним і багатогранним процесом, що включає обмін інформацією, взаємодію та сприйняття інших людей. Успішне спілкування потребує інтеграції різних аспектів, таких як комунікативний, інтерактивний, перцептивний та фатичний, а також розуміння психологічних механізмів, які визначають взаєморозуміння. Психологія спілкування сприяє оптимізації взаємодії між людьми та розвитку комунікативних навичок, що є важливими для ефективної співпраці в різних сферах діяльності.

ЛІТЕРАТУРА

1. Адамович, А. Є., Шлєіна, Л.І. (2021). Посібник-практикум з дисципліни «Основи ораторського мистецтва». Мелітополь: ФО-П Однорог Т. В., URL: http://www.tsatu.edu.ua/shn/navchannja/posibnyky/

2. Литвинов, В. (2002). Риторика. Філософський енциклопедичний словник / В. І. Шинкарук (гол. редкол.) та ін. Київ : Інститут філософії імені Григорія Сковороди НАН України.

3. Чепіга, П. (2000). *Риторика. Українська мова: енциклопедія*. НАН України, Інститут мовознавства ім. О. О. Потебні, Інститут української мови; ред. В. М. Русанівський та ін. Київ : Українська енциклопедія.

4. Куньч, . З. Й., Городиловська, Г. П., Шмілик, І. Д. (2018). Риторика : підручник / 2-е вид., допов. Львів : Львівська політехніка.

5. Шлєіна, Л. І. (2016). Самостійна робота майбутніх фахівців у процесі вивчення курсу української мови професійного спрамування. *Збірник науково-методичних праць «Удосконалення навчально-виховного процесу в вищому навчальному закладі*. Випуск 19 Таврійський державний агротехнологічний університет. Мелітополь. 190-197.