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CONTENT

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INTERNATIONAL MODELS OF PUBLISHING REGULATION

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ABSTRACT

In the context of globalization and digital transformation, the regulation of the publishing industry is becoming increasingly relevant, as only balanced state, institutional, and professional approaches can ensure the sustainable development of the book sector. The Ukrainian model of publishing regulation is still in the process of formation, and studying international experiences is a necessary step toward adapting effective practices to the national context.

This article aims to analyze publishing regulation models in countries such as Germany, France, the United Kingdom, Canada, Poland, and Australia, with a focus on institutional mechanisms, legal frameworks, forms of financial support, and the role of professional associations. It demonstrates that several typical models exist-interventionist, corporatist, liberal-regulated, federal, and transitional-which differ in the degree of state involvement, the level of autonomy of the professional community, and the motivation systems for preserving cultural diversity in publishing.

The purpose of the research is to systematize global regulatory models of the publishing industry and identify elements that may be relevant for implementation in Ukraine. The article examines contemporary theoretical and methodological approaches to regulation in the creative industries, with a particular emphasis on publishing. It outlines key models of state intervention and self-regulation based on the examples of France, Germany, the UK, Canada, Poland, and Australia. Legal, economic, and institutional tools used to support the publishing sector are analyzed, and practices relevant to the Ukrainian context are highlighted to strengthen cultural policy effectiveness in the book sector.

The methodological framework is based on comparative analysis using general scientific methods of systematization, generalization, and content analysis of legal acts, reports, and analytical materials from professional organizations.

The scientific novelty lies in the attempt to typologize publishing regulation models in the global context and outline ways to integrate best practices into the Ukrainian book market system. The study concludes that successful models are characterized not only by stable legal frameworks but also by ongoing cross-sectoral co-

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operation-between the state, professional associations, educational institutions, and international donors. Adapting elements of these models to Ukraine may enhance the efficiency of the publishing industry, ensure its sustainable development, and strengthen its cultural mission.

Keywords

Global models, publishing, regulation, publishing policy, state support, international experience.

Classification JEL: L82, Z11, H11, O57

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INTRODUCTION

In today's globalized world, book publishing is not only a sector of the creative economy but also an important tool for shaping cultural identity, disseminating knowledge, and supporting democratic values. In recent years, Ukraine has witnessed dynamic growth in its book industry. According to the Ukrainian Book Institute, over 14.7 million copies of books were published in the first half of 2025 – an increase of 37% compared to the same period of the previous year, indicating a significant rise in production volumes (The number of book titles..., 2025). Additionally, a 2020 study by the British Council in Ukraine, conducted in partnership with the Ukrainian Book Institute, highlighted positive developments in the sector, including an increased focus on quantitative analysis of the publishing market and reading practices, which contributes to more strategic planning in the field (British Council Ukraine & Ukrainian Book Institute, 2020).

However, the overall state of the publishing sector in Ukraine remains unstable. The full-scale invasion has caused severe damage to the industry: many publishing houses, printing facilities, and bookstores, particularly in front-line regions, have been destroyed or forced to cease operations. Some publishers have lost their offices, equipment, and warehouse assets and are now operating under challenging logistical conditions.

A separate and pressing issue is the lack of effective and stable state policy for supporting book publishing. Funding programs are either not implemented at all or are carried out sporadically and with delays, which deprives publishers of the ability to plan their activities and bring competitive products to market (Afonin, 2020, p. 3; Arts Council England, n.d.).

That is why the study of global models for regulating book publishing is particularly relevant. Analyzing the institutional, legal, and economic approaches applied in other countries not only allows us to assess the effectiveness of various instruments but also helps identify best practices that can be adapted to the Ukrainian context. The experience of these countries demonstrates that well-designed government intervention can serve as an effective mechanism for preserving cultural diversity, supporting national book publishing, and encouraging reading among the population.

It is important to note that in different countries around the world, the state plays varying roles in regulating the publishing sector: ranging from complete non-intervention to active involvement in legislative, financial, and institutional support. These differences have led to the development of diverse regulatory models shaped by the historical, political, economic, and cultural characteristics of each country.

Over the past decades, scholarly debates have increasingly focused on the necessity and effectiveness of state intervention in the publishing sector. These discussions span a wide range of issues: from the justification of subsidizing publishing projects to setting fixed book prices, offering tax incentives, supporting libraries, and regulating copyright.

LITERATURE REVIEW

Among the key approaches to analyzing models of publishing industry regulation, special attention should be given to the economic concept of the creative industries proposed by American scholar Caves R. E. (Caves, 2000). The author views book publishing as a form of the creative economy that combines artistic production with the commercial distribution and

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consumption of cultural products. Given these characteristics, Caves emphasizes the need for external regulation of creative sectors, particularly publishing, through the involvement of the state or independent institutions. Such involvement should ensure not only market stability but also cultural diversity and access to works that may not be commercially attractive but are socially significant.

This view is supported by researchers De Prato G. and Simon J.-P., who in their works analyze a range of public policies implemented in European Union countries to support the publishing sector. They stress that such intervention is justified not only by economic considerations but also by socio-cultural objectives: protecting cultural diversity, supporting independent publishers and bookstores, preserving local book production, and ensuring broad access to knowledge. In today's environment, where the market is increasingly dominated by global platforms, public policy, in their view, must adapt to new realities while maintaining a balance between regulation and creative freedom (De Prato & Simon, 2022).

Levi-Faur D. argues that even in liberal and globalized market conditions, the state does not abandon its intervention tools but rather transforms them in response to the challenges of the new economy. In his view, regulation becomes not only a means of restraining the market but also a way to uphold the public interest by creating rules, institutions, and policies that establish a level playing field, protect national industries, and preserve cultural diversity (Levi-Faur, 2013).

When studying models of publishing industry regulation, it is important to consider not only cultural or institutional aspects, but also economic and legal approaches that explain the rationale behind state intervention in market processes. One of the most influential theorists in this field is the British scholar Ogus A., who in his works justifies the necessity of regulation through a range of economic instruments (Ogus, 2004; Ogus, 1994).

Furthermore, in the context of digital transformation, traditional forms of publishing regulation are increasingly being complemented by more flexible approaches, such as co-regulation and self-regulation. Belgian scholar Verhulst S. emphasizes in his research that effective governance of the media and communication sector is no longer limited to state instruments alone. Instead, he proposes a multistakeholder governance model in which functions of control, norm-setting, and monitoring are shared among the state, professional associations, civil society organizations, and digital platforms (Verhulst, 2010).

Australian scholar Drahos P. highlights that regulatory policy in the field of culture and publishing must be built on the principles of equal access, transparency, and the protection of cultural sovereignty. In this context, he supports the idea of active state involvement in counteracting the monopolization of the knowledge market and in developing legal mechanisms that ensure the proper functioning of the publishing industry as a component of cultural policy (Drahos, 2004).

OBJECTIVE

The aim of this research is to systematize and analyze global models of publishing industry regulation in order to identify effective legal, institutional, and economic mechanisms that could be adapted to the Ukrainian context for improving national publishing policy.

To achieve the stated objective, the following research tasks were identified:

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- To define theoretical and methodological approaches to the concept of regulation in the field of creative industries, particularly in book publishing;
- To describe key regulatory models of the publishing industry using the examples of selected countries (France, Germany, the United Kingdom, Canada, Poland, and Australia);
- To analyze the legal, economic, and institutional tools applied within various regulatory models;
- To identify relevant practices and formulate recommendations that could be adapted to the Ukrainian legislative and governance framework to support the development of the national publishing sector.

METHODOLOGY

The methodological framework of the study is based on a comprehensive interdisciplinary approach, combining tools from legal studies, cultural economics, political science, and communication theory. General scientific methods of analysis, synthesis, induction, deduction, and comparison were employed. The primary focus is placed on a comparative analysis of regulatory models in selected countries (France, Germany, the United Kingdom, Canada, Poland, and Australia), taking into account their legal, economic, and institutional specificities.

The study also utilized content analysis of legal acts, strategic documents, and official reports from relevant institutions (e.g., Centre National du Livre, Börsenverein, Arts Council England, Instytut Książki), as well as academic works by leading scholars such as Caves R., Ogus A., Drahos P., Verhulst S., Weber M., Dain A., and others. A case study approach was applied to examine in more detail the unique national strategies and practices for regulating the publishing sector.

To understand the current transformations in cultural policy and the book publishing market, theoretical concepts of creative industries, models of co-regulation and self-regulation, as well as critical approaches to the analysis of the global knowledge and intellectual property market were applied. This enabled the identification of both commonalities and differences between regulatory models, and provided an analytical foundation for determining relevant practices that could be adapted to improve the regulatory system of the publishing sector in Ukraine.

RESULTS AND DISCUSSION

Modern international organizations provide clear definitions of the concept of "creative industries," emphasizing their cultural and economic significance. According to UNESCO, creative or cultural industries are sectors that encompass the creation, production, and commercialization of intangible cultural products, which are typically protected by copyright and can exist as goods or services (UNESCO, n.d.-a). This understanding allows publishing to be recognized not only as part of the educational or informational sector but also as a full-fledged component of the creative economy.

The definition proposed by the United Kingdom's Department for Culture, Media and Sport describes creative industries as fields based on individual creativity, skill, and talent, which have the potential to generate wealth through the exploitation of intellectual property (Department for Culture, Media and Sport, 2001). The Department for Culture, Media and Sport includes in this category such subsectors as advertising and marketing, ar-

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chitecture, crafts, design, fashion, film, television, radio, photography, museums, galleries, libraries, music, performing and visual arts, publishing, information technology, software, and computer services.

Including publishing within this industry is significant because it highlights the dual nature of the publishing sector. On the one hand, it is cultural, fulfilling the function of preserving, transmitting, and shaping national identity. On the other hand, it is economic, with the capacity to create jobs, support exports, and drive innovation. Therefore, the theoretical understanding of publishing as part of the creative industries serves as a foundation for developing an effective regulatory model for this sector at both national and international levels.

Given the dual nature of publishing (both cultural and economic), its development requires a regulatory approach that takes into account its societal mission as well as the market conditions under which it operates. The publishing sector not only generates employment, supports national production, and exports intellectual products, but also plays a strategic role in the dissemination of knowledge, the shaping of worldviews, and the preservation of linguistic and cultural diversity. For this reason, in most countries with a well-developed cultural policy system, publishing is supported through specialized programs, legislative instruments, institutions, and tax incentives. This positioning of the publishing sector as part of the creative economy ensures its inclusion in national strategies for cultural development and digital transformation.

France is a vivid example of a model characterized by active state intervention in publishing regulation, built upon a deliberate state policy aimed at preserving cultural pluralism and ensuring equal access to books. The cornerstone of this policy is the Lang Law of 1981, which introduced a fixed book price regime. Under this system, retailers are required to sell books at the price set by the publisher, with a permitted discount of no more than 5% (Sénat, 1981). This regulation is intended to protect small and independent bookstores from market monopolization by large chains and online retailers.

At the same time, a key role in shaping and implementing cultural policy in the field of publishing is played by the state institution Centre National du Livre, which operates under the auspices of the French Ministry of Culture. The Centre National du Livre provides financial support to authors, translators, publishers, and booksellers, and also implements programs to promote reading, particularly among youth and socially vulnerable groups (Centre National du Livre, n.d.). Overall, the French system of publishing support includes direct subsidies, tax incentives, infrastructure support, and legal guarantees that ensure the stable functioning of the book market as an integral part of national cultural policy (Simon, 2018).

Unlike France, where the system of support for book publishing is cohesive, consistent, and implemented through the institutionalized structure of the Centre National du Livre, the mechanisms of state intervention in Ukraine remain fragmented. It is worth noting that the Ukrainian Book Institute, established in 2016, plays an important role in shaping publishing policy. It serves as the central institution for implementing programs that promote reading, popularize Ukrainian books, supply libraries, support translators, and promote Ukrainian authors abroad (Verkhovna Rada of Ukraine, 2016). However, unlike the Centre National du Livre, the Ukrainian Book

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Institute lacks sufficient financial independence, stable multi-year funding, or regulatory tools to influence pricing policies and market regulation.

Its activities are limited to executing state programs (notably, "Ukrainian Book" and "eBook"), which are often subject to fluctuations in budget allocations, shifting government priorities, and political context. Furthermore, Ukraine has yet to implement legislative mechanisms for fixed retail book prices, as is the case in France. This creates unequal conditions for independent bookstores and local publishers.

To move toward a European-style model of active state involvement, Ukraine needs not only to strengthen the role of the Ukrainian Book Institute but also to adopt a stable, long-term cultural policy strategy for publishing, with predictable funding and legislative guarantees.

Germany implements a corporatist model of publishing sector regulation, where professional associations play a central role. The key actor in this system is the Börsenverein des Deutschen Buchhandels, the German Publishers and Booksellers Association, which functions not only as a lobbying organization but also as a primary market regulator. It coordinates interaction between publishers, booksellers, libraries, and state institutions (Börsenverein des Deutschen Buchhandels, n.d.).

Although the state provides indirect support to the sector through tax incentives (such as the reduced 7% VAT rate on books) and certain cultural funding programs (Avalara, n.d.; Oldiges, 2019), the primary regulatory functions are delegated to the professional community itself. This allows for greater flexibility in responding to market changes and helps preserve cultural self-regulation.

A key element of this model is the fixed book price law, which stipulates that all retailers must sell new book releases at the same price set by the publisher. This mechanism ensures fair competition between large retail chains and small independent bookstores, while also contributing to the preservation of book infrastructure in smaller towns and communities (Bundesministerium der Justiz, n.d.).

Compared to Germany's corporatist model, Ukraine has the Ukrainian Publishers and Booksellers Association, which acts as an industry representative, participates in legislative processes, initiates advocacy campaigns, and collaborates with government bodies and international partners (Shyrokova, 2025). However, unlike in Germany, the Ukrainian Publishers and Booksellers Association does not have a formalized status as a market self-regulator and lacks the authority to enforce control or coordinate the sector at the national level.

Moreover, Ukraine does not currently have a fixed book price mechanism or a systematic tax policy aimed at the long-term support of the publishing industry. For example, while the reduction of VAT on books to 7% (as in Germany) has been the subject of separate campaigns in Ukraine, this rate has not yet been firmly established and remains the topic of political debate.

In the United Kingdom, the publishing sector operates largely as a liberally regulated industry. State involvement is limited to the creation of a regulatory framework and supporting structures, while the main regulatory functions are performed by professional organizations.

Library policy in the United Kingdom also operates within a self-regulatory framework, supported by the state through indirect mech-

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anisms. Arts Council England funds public libraries, literary programs, and reading development initiatives through a system of grants (Arts Council England, n.d.). At the same time, the Department for Culture, Media and Sport is obligated, under the Public Libraries and Museums Act of 1964, to report annually to Parliament on the state of the library network, its effectiveness, and its engagement with local communities (Department for Culture, Media and Sport, 2023).

Within the liberal regulatory approach to publishing in the United Kingdom, professional organizations have traditionally played the leading role rather than direct government intervention. In particular, the Publishers Association, founded in 1896, serves as the main professional body of the sector, representing publishers' interests before the government, coordinating regulatory efforts through professional dialogue, and shaping market strategies (Publishers Association, n.d.).

The British model is characterized by a predominantly liberal approach to regulation, where the key functions of development and representation of the publishing sector are performed by the professional community, while the state limits itself to providing a regulatory environment and cultural infrastructure, particularly through the library system. Unlike France and Germany, where fixed book pricing and stable public funding serve as essential instruments for protecting national publishing, institutional support in the United Kingdom is provided indirectly through Arts Council England and the programmatic reporting of the Department for Culture, Media and Sport.

In this context, the Ukrainian model shares certain features with the British one, particularly in its attempts to delegate some sectoral development functions to specialized institutions such as the Ukrainian Book Institute and in its efforts to expand library infrastructure. However, unlike the United Kingdom, Ukraine lacks a stable mechanism for cooperation between the state and professional associations like the Ukrainian Publishers and Booksellers Association, and it has not yet developed a robust self-regulation system for the industry. Moreover, despite the formal existence of support programs, their practical effectiveness is limited due to fragmented implementation, political instability, and dependence on changing government priorities.

The Canadian model of publishing regulation is characterized by a high level of government involvement, primarily aimed at supporting cultural diversity, developing the domestic market, and promoting national content abroad. The central tool of public support is the Canada Book Fund, a program administered by the Department of Canadian Heritage, which provides funding for both publishing houses and professional organizations. The Publishing Support subcomponent offers assistance to independent publishers for the production, marketing, and distribution of books by Canadian authors, as well as for the export of their titles to international markets (Department of Canadian Heritage, 2023a). Another subcomponent, Support for Organizations, provides funding to non-profit entities, industry associations, and professional bodies to implement projects focused on sector development (Department of Canadian Heritage, 2023b).

Alongside the Canada Book Fund operates the Canada Council for the Arts – a national cultural institution that manages a range of grant programs, including the Public Lending Right, which compensates authors for the

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availability of their works in public libraries (Canada Council for the Arts, n.d.). Through these instruments, Canada not only supports publishers but also creates conditions for the economic stability of authors, enhances the prestige of national literature, and ensures its accessibility to the public. Overall, publishing policy is coordinated at the level of the Department of Canadian Heritage, which integrates support for publishing into the broader cultural context of national identity (Department of Canadian Heritage, n.d.).

Compared to Canada, the Ukrainian model remains at the stage of institutional development. The Canadian approach represents an example of institutionally stable government intervention, where the publishing industry is treated as a key tool of cultural policy and national identity. Through programs such as the Canada Book Fund and Public Lending Right, support is extended to both content producers (publishers) and creators (authors), as well as to industry associations, fostering the balanced development of the entire publishing ecosystem. Additionally, coordination by the Department of Canadian Heritage ensures long-term political and financial sustainability.

Poland represents a transitional model of publishing regulation that combines market-based mechanisms with active government support through specialized institutions. A key player in the sector is the Instytut Książki, a national cultural center established by the Ministry of Culture. The Instytut Książki promotes reading, supports authors, translators, publishers, libraries, and book distributors, and is also responsible for the international promotion of Polish literature. Notably, it manages the ©POLAND Translation Programme, which provides funding for translations of Polish authors into various languages (Polish Book Institute, n.d.-a; UNESCO, n.d.-b).

In addition, the Polish publishing community has been discussing the introduction of fixed book pricing similar to France's "Lang Law" as a means of protecting local booksellers, supporting cultural diversity, and adapting to declining sales. In 2013, the Polish Chamber of Books developed a draft law proposing that fixed prices be maintained for 18 months after publication, allowing for limited discounts by booksellers (Adamowski, 2013).

Poland's regulatory model in publishing serves as an example of institutionally framed cultural policy that merges public support with market mechanisms. The Instytut Książki functions as a stable coordinator of national programs related to reading promotion, translation, and international outreach. Meanwhile, discussions on the implementation of fixed book prices are ongoing, but no legislative decision has yet been adopted. Against this backdrop, Ukraine demonstrates similar ambitions, though with a lower level of implementation.

The Australian model of publishing regulation is characterized by a hybrid approach that combines culturally oriented state intervention with the market autonomy of industry participants. Creative Australia acts as the key institutional player, providing funding for literary initiatives, including grants for text creation, publication, market development, and audience support (Creative Australia, n.d.).

In 2025, within the framework of the Revive cultural policy, a new coordinating body Writing Australia was established with funding of over 26 million USD for a three-year period. Its mandate includes supporting authors and publishers, building literary institutions, launching national programs, and appointing

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a National Poet Laureate to promote poetry and literature at both national and international levels (Cain, 2025; Australian Government, 2025).

This approach enables Australia to maintain a healthy book ecosystem: market freedom is preserved, while expert governance, systematic support, and strategic planning in the cultural sector are ensured. By comparison, the Ukrainian model is currently less structured. Although the Ukrainian Book Institute performs regulatory and support functions, it is limited by the lack of stable funding, the absence of a legislatively defined strategy, and insufficient institutional autonomy. Ukraine also lacks a dedicated organization comparable to Writing Australia – one with a specific budget and strategic responsibility for the development of the literary sector.

CONCLUSIONS

1. As a result of the conducted research, the approaches to regulating the publishing sector within the context of its inclusion in the creative industries were systematized, and the key cultural policy models of France, Germany, the United Kingdom, Canada, Poland, and Australia were analyzed. It was found that effective models of publishing sector functioning are based on a clearly defined state strategy, stable funding, an active role of dedicated institutions, as well as mechanisms such as fixed book pricing and preferential taxation.
2. It was revealed that in countries with well-developed cultural policies (France, Germany, Canada), the state plays a central role in supporting publishing, acting as a guarantor of cultural diversity, fair competition, and accessibility of books. In contrast, the United Kingdom and Australia demonstrate models with a higher degree of self-regulation and institutional autonomy of the sector, which is compensated by strong professional associations and cultural agencies. Poland represents a transitional approach that combines active state involvement with elements of market flexibility.
3. The Ukrainian model is currently in a formative stage. While it includes institutional efforts for support through the Ukrainian Book Institute, it is characterized by fragmented implementation, a lack of long-term strategies, absence of fixed book pricing mechanisms, stable funding, and consistent tax policy. Professional associations, including the Ukrainian Publishers and Booksellers Association, do not have formal regulatory status and have limited influence on policymaking.
4. Successful international examples show that an effective regulatory model requires not only a stable legal framework but also well-established cross-sectoral cooperation between the state, professional community, educational institutions, cultural organizations, and international donors. Such cooperation enables the balanced development of the book ecosystem.
5. Therefore, the adaptation of selected elements from leading global models to the Ukrainian context, including the introduction of a stable state support program, implementation of fixed book pricing, tax incentives, and the expansion of powers of dedicated institutions, represents a promising direction for improving national cultural policy in the field of publishing and enhancing its overall effectiveness.

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University science

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UNIVERSITY SCIENCE

MODERN APPROACHES TO THE STUDY OF THE CHEMICAL-TOXICOLOGICAL CHARACTERISTICS OF PHENYLALKYLAMINES USING THE CASE STUDY METHOD

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ABSTRACT

The purpose of the investigation is to introduce the Case Study model into the pedagogical process when studying toxic substances. Among the highly toxic substances studied in the discipline "Toxicological and Forensic Chemistry", the group of phenylalkylamines attracts special attention. Phenamine or amphetamine, which is close to adrenaline and noradrenaline in chemical structure, is considered a classic psychomotor stimulant. Due to side effects in the form of disorders of the functions of the higher nervous system, frequent paradoxical reactions, the development of addiction and drug dependence, phenamine is not used in Ukraine. When teaching the discipline "Toxicological and Forensic Chemistry", phenylalkylamines are studied according to the following plan: representatives of the group and the peculiarity of their chemical structure, toxicological significance and symptoms of poisoning, objects of study, metabolic pathways and metabolites (active, inactive), isolation methods from research objects, methods of qualitative detection and quantitative determination of phenylalkylamines, antidote therapy. In order to ensure a comprehensive consideration of phenylalkylamines as objects of chemical and toxicological research in the educational process, it is important to use the Case study method. With the help of a case study, solutions are planned when studying the problems of chemical and toxicological analysis of phenylalkylamines and recommendations are developed for planning research - descriptive and problem cases, and the key strengths of the research are identified using a SWOT analysis. The current task remains to improve the educational material on the chemical and toxicological analysis of phenylalkylamines by highlighting the latest analysis methods and modern chemical modifications of the structure of compounds of this group. Using the example of a class of toxic substances - phenylalkylamines, the methods of implementing the Case Study model into the educational process were demonstrated, which confirmed its effectiveness and efficiency in mastering the discipline "Toxicological and Forensic Chemistry".

Keywords

Phenylalkylamines, amphetamine, chemical-toxicological analysis, toxicological and forensic chemistry, higher education, case study.

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INTRODUCTION

The discipline «Toxicological and Forensic Chemistry» is taught at the Faculty of Pharmacy of the O.O. Bogomolets National Medical University for 4th-year students in accordance with the educational program (EP) «Pharmacy» of the second (master's) level of higher education in the specialty I8 «Pharmacy» and opens up to students the opportunity to get acquainted with advanced methods of isolating and analyzing xenobiotics - poisonous and highly toxic substances in objects of various origins (cadaveric material, human biological fluids, plants, medicines, pesticides, etc.). A feature of chemical-toxicological analysis is the ability to detect and quantify xenobiotics and their metabolites, which often play an important role in the «lethal» synthesis in the body of a poisoned person. Among the class of poisonous «medicinal» substances, the group of phenylalkylamines attracts special attention. The derivative of phenylalkylamine - amphetamine or phenamine - has serious side effects in the form of disorders of the functions of the higher nervous system, causes paradoxical reactions and the development of addiction and drug dependence. Phenamine is not used in Ukraine. However, other phenylalkylamines are used in medical practice, which often cause suicidal and criminal poisoning of people. After taking 1 mg/kg of amphetamine, a person may die. The toxic dose of amphetamine depends on the individual sensitivity of the body and other factors. When teaching the discipline "Toxicological and Forensic Chemistry", phenylalkylamines are studied according to a comprehensive plan according to the Case study method. This method is used in the educational process to ensure a comprehensive consideration of phenylalkylamines as objects of chemical and toxicological research. With the help of Case studies, ways to solve problems of chemical and toxicological analysis of phenylalkylamines are planned and descriptive and problem cases are developed. According to the requirements of the Case study, the purpose of the study and research (situational tasks) is determined, motivated selection of samples for the study - targeted analysis, formation of a research plan with a deadline, systematization of the obtained data (basic or statistical), identification of key strengths of the study using SWOT analysis, predicting potential threats – determining theoretically active toxic metabolites using computer programs for predicting the toxicity of compounds, etc. A comprehensive approach is being developed to study the entire group of compounds with a similar chemical structure while studying each representative of the phenylalkylamine group. The current task remains to improve the educational material on the chemical and toxicological analysis of phenylalkylamines by highlighting the latest methods of analysis and modern chemical modifications of the structure of compounds of the specified group.

LITERATURE REVIEW

Amphetamine-type stimulants (ATS) are a category of psychostimulants. According to their chemical structure, they are classified as phenylalkylamines. Phenylalkylamines include amphetamine, ecstasy, and other substances. Amphetamine abuse is a global modern problem. According to the United Nations Office on Drugs and Crime, an estimated 54 million people worldwide used ATS in 2020. Of these, 34 million used amphetamine and 20 million used ecstasy. In 2021, approximately 60% of amphetamine abuse cases were reported in East and Southeast Asia. Most people who abuse amphetamines are between the ages of 10 and 18. In Iran, 5–12% of high school students have experi-

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enced an amphetamine relapse [Chai et al., 2024; Moran et al., 2024; Ling et al., 2013; World Drug Report, 2020; World Drug Report, 2021; Asante & Atorkey, 2023]. In Thailand, substance abuse has become a serious social problem. Among the Thailand population aged 15 to 24, 39% have used illicit drugs, amphetamines, crystal methamphetamine [Nardilok, 2020; Nagy et al., 2022; Brecht et al., 2000; Dalsgaard et al., 2020; Krass et al., 2021; Saunders et al., 2022].

A serious problem after successful detoxification and rehabilitation in individuals with substance use disorders (SUD) is the high rate of relapse. More than 50% of patients with SUD relapse after treatment and rehabilitation [Rolls, 2013; Ridder, 2017; Brecht et al., 2000]. Studies show that relapse rates range from 40 to 75% and confirm the high relapse rates among ATS users.

Assessing a person's resilience to substance use requires studying risk factors and protective factors to promote successful adaptation. The development of standardized tools to assess «amphetamine resilience» remains important. Screening adolescents undergoing treatment for amphetamine addiction is particularly relevant.

Resilience is viewed as a dynamic process with three components – identification of risk and protective factors for drug use, motivation and making informed decisions against drug use, and skills in applying strategies to curb drug use. This perspective is important for conceptualizing resilience to drug use. There is currently no definitive standard for measuring resilience. The Adolescent Resilience Factor Scale (RFS) is designed to assess protective factors against alcohol use. Such instruments often consider resilience only from an individual perspective and do not capture all possible sources of negative impact on the body. There is a lack of tools to comprehensively measure resilience as a multifactorial concept. The development of such tools expands the possibilities of tailoring individualized care for rehabilitation and relapse prevention in people treated for amphetamine dependence.

Phenylalkylamines are an important group of highly toxic and poisonous substances that are objects of chemical-toxicological analysis [Tsekhmister & Welchinska, 2016; Welchinska et al., 2024]. In order to ensure a comprehensive consideration of phenylalkylamines as objects of chemical-toxicological research in the educational process, it is important to use the Case study method.

With the help of Case study, ways of solving problems of complex study of chemical-toxicological analysis of phenylalkylamines are planned and recommendations for planning research are developed - descriptive and problem cases. The Case study method is a type of problem-oriented learning. It allows you to implement tasks and model an experiment, offer non-standard approaches and find ways to solve the problem. Case study is a broader approach to studying an object [Seawright & Gerring, 2008; Sikora, 1999; Sheremeta & Kanishchenko, 1999].

The research work is intended to generalize, and the conclusions can be related to a larger set or volume. The following analysis methods are used: illustrative applied research, applied research, aggregate applied research, descriptive applied research, instrumental applied research [Koycheva & Yanovskaya, 2023; Joia, 2002; Hellstrom et al., 2005].

Case study allows you to form different research designs: methodological work, single and multiple research designs, "building a realistic picture" design, "anomaly" detection design. These designs are often used in com-

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bination. An effective method is to choose the number of studies and objects that will provide a high expected increase in information. The typology of Case studies includes the definition of objectives, approaches (theoretical justification), choice of processes (single or multiple), choice of study (retrospective, diachronic, parallel, sequential) [Godswill, 2022; Erkan et al., 2023; Pelo et al., 2020; Samuel, 2020; Moskalenko et al., 2011]. Case studies as a form of qualitative research help to inform and make evidence-based decisions in various fields. This approach is valuable for scientific research in the field of health care.

The Case Study method has been successfully transferred to the study of the group of phenylalkylamines using an integrated approach to mastering the various characteristics of these compounds as objects of chemical-toxicological analysis [Nizhenkovska et al., 2020; Welchinska & Nizhenkovska, 2022; Welchinska, 2017; Welchinska & Vilchynska, 2016].

OBJECTIVES

To introduce basic approaches of the Case study method into a comprehensive study of phenylalkylamines as objects of chemical and toxicological analysis during the assimilation of educational material of the discipline «Toxicological and Forensic Chemistry» by students of the Faculty of Pharmacy of the O.O. Bogomolets National Medical University in order to modernize it and increasing the effectiveness of understanding by higher education applicants in higher education institutions of Ukraine in accordance with the educational program (EP) “Pharmacy” of the second (master’s) level of higher education in the specialty I8 “Pharmacy” with the subsequent use of the acquired knowledge in practical activities.

METHODOLOGY

The main stages of studying each class of poisonous and highly toxic substances according to the requirements of the Case study are determining the purpose of the study with the motivation of the need to perform specific studies, motivated selection of samples for study - purposeful, drawing up a study plan and research with setting a deadline, systematization of the obtained data, use of SWOT analysis to predict potential threats to experiments and unplanned changes in work strategy. It is important to predict potential threats - determination of theoretically active toxic metabolites using computer programs for predicting the toxicity of compounds, etc. When teaching the discipline “Toxicological and Forensic Chemistry”, phenylalkylamines are studied according to the following plan: representatives of the group and the peculiarity of their chemical structure, toxicological significance and symptoms of poisoning, objects of study, metabolic pathways and metabolites (active, inactive), isolation methods from research objects, methods for qualitative detection and quantitative determination of phenylalkylamines, antidote therapy.

RESULTS AND DISCUSSION

According to the Case study typology, we used a single- and multiple-research design when studying phenylalkylamines.

Representatives of this group of compound are amphetamines: *amphetamine* (benzedrine, biphetamine, phenylisopropylamine), *methylamphetamine, methamphetamine* («batu», desoxyn, phenylisopropyl-N-methyl-amine hydrochloride), dextroamphetamine (dexamyl, dexedrine), *MDA* (3,4-methylenedioxyamphetamine), *MDMA* («ecstasy», 3,4-methylenedioxymethamphetamine), *MDEA* (3,4-methylenedioxy-N-eth-

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ylamphetamine), *MMDA* (3-methoxy-4,5-methylenedioxyamphe-tamine) and other.

Using and toxicological significance of phenylalkylamines (ATS). Amphetamines – are compounds with structure similar to phenyl ethylamine or phenyl isopropylamine, added side chains promote different levels of catecholamine and serotonine activity. Dextroamphetamine, methylphenidate are used in the treatment of narcolepsy and attention-deficit hyperactivity disorder *(ADHD).* Fenfluramine, dexfenfluramine were used for weight loss but later recalled due to cardiopulmonary toxicity when used in combination with phentermine.

Amphetamines are popular among the persons, poorly adaptable to social conditions, it is difficult to get used to a new lifestyle. These drugs activate the internal excitation mechanisms. Antisocial and schizoid persons prone to abuse of amphetamines. The use of amphetamines is not for medical purpose is typical for individuals seeking to improve their performance. Attempts to reduce the dose to cause drowsiness and depression.

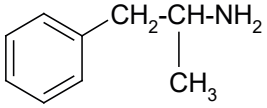
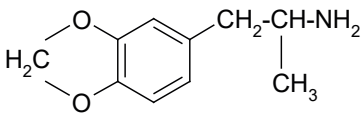
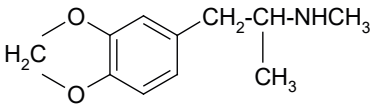
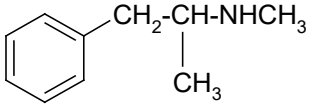
MDMA is a psychoactive amphetamine derivative, when amphetamine abuse observed reactions: dysphoria, tachycardia, hypertension, high blood pressure. *MDMA* is in 1-6 times more potent than mescaline and 1.5–3 times less toxic than *MDA*. Mescaline is a hallucinogenic alkaloid present in peyote that is structurally related to amphetamines and is a 5-HT_2 agonist.

The adverse effects of chronic amphetamine intoxication are anorexia, paranoia, cardiomyopathy, pulmonary hypertension, vasculitis, aortic and mitral regurgitation.

The clinical signs of acute amphetamine intoxication are agitation, anxiety, AMS (altered mental status), mydriasis, hypertension, tachycardia, diaphoresis, tremor, muscle rigidity, hyperthermia, seizures. There is the sympathomimetic toxidrome. Chemical formulas of these medications showed (Table 1).

Table 1. Chemical formulas of phenylalkylamines.

Source: Welchinska, 2017.

ATS	Chemical formula
Amphetamine (benzedrine, biphetamine), (*RS*)-1-phenylpropan-2-amine, Phenyl isopropyl-amine, *D*- and *L*-isomers	
MDA, 3,4-methylenedioxyamphetamine	
MDMA («ecstasy»), 3,4-methylenedioxymethamphetamine	
Methylamphetamine, (methamphetamine, «batu», desoxyn), phenylisopropyl-N-methyl-amine hydrochloride, *D*- and *L*-isomers	

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Metabolism of phenylalkylamines (ATS). Amphetamines bind to the monoamine transportes and increased extracellular levels of the biogenic amines dopamine, norepinephrine and serotonin. Amphetamines metabolized in the liver. These compounds are absorbed in the small intestine, partially bind to proteins, excreted in native form and in the form of metabolites. The biological material for investigation are: internal organs: stomach with its content, intestine with its content, liver, kidneys, spleen; liquids: blood, urine, stomach washings; hair, sweat, nails, saliva.

Persons which reached the state of euphoria, tend to increase the dose of amphetamine with 20–40 mg / day to about 50–150 mg / day. The minimum lethal dose of amphetamine depends on the age and lifestyle of the person. Lethal dose of 1.5 mg / kg (methamphetamine); 0.5–0.7 mcg / ml in blood, 28 mg / kg (amphetamine).

Metabolism for amphetamine and methamphetamine takes place in the liver in the following ways: 1) N-demethylation; 2) oxidation (hydroxylation); 3) dezamination; 2) conjugation (glucuronides, sulphates) (Fig. 1–4):

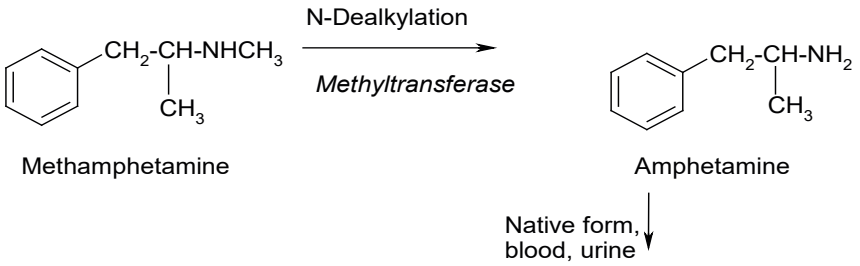

Figure 1. Metabolism of Methamphetamine.

Source: Welchinska, 2017.

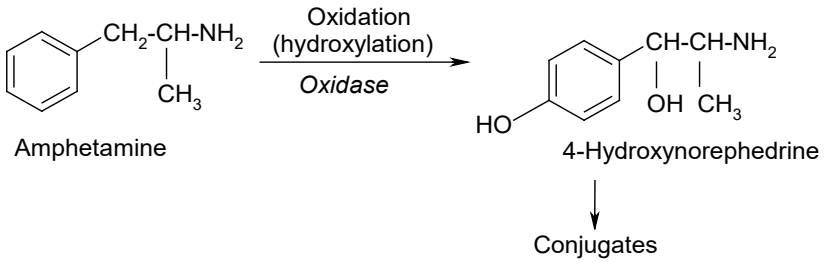

Figure 2. Metabolism of Amphetamine. Source:

Source: Welchinska, 2017.

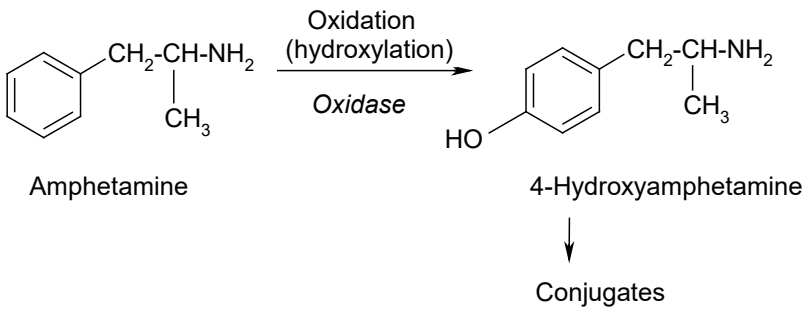

Figure 3. Metabolism of Amphetamine.

Source: Welchinska, 2017.

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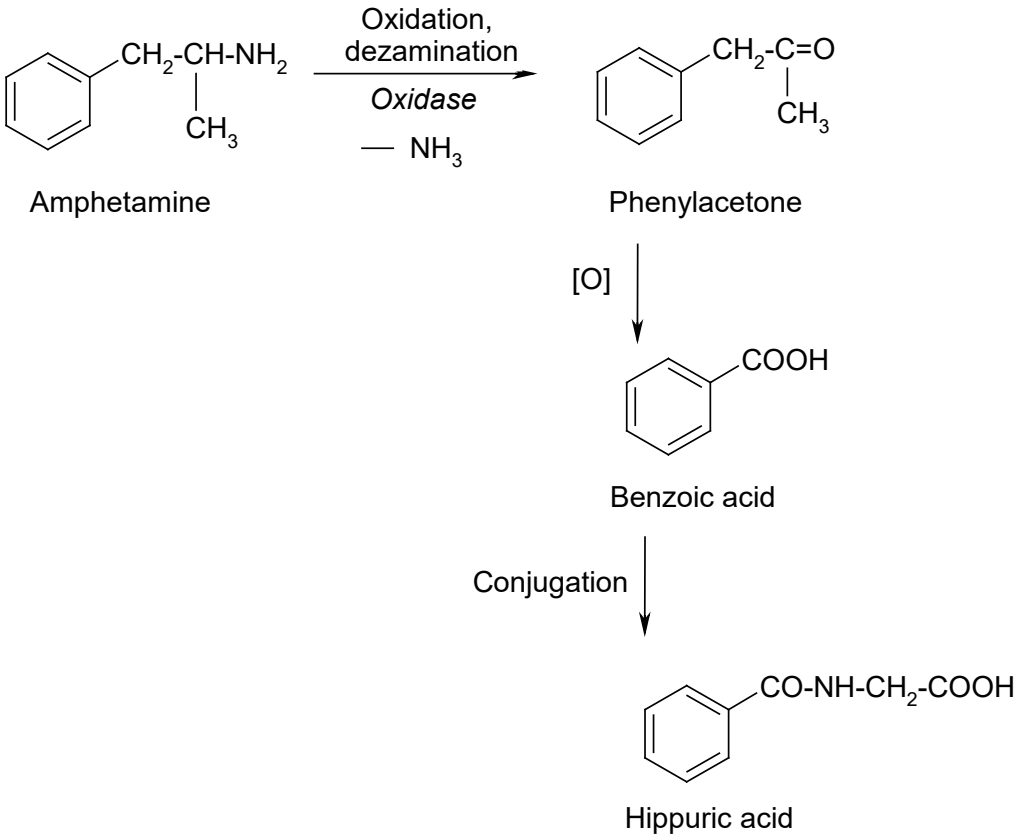

Figure 4. Metabolism of Amphetamine – I and II Phases.

Source: Welchinska, 2017.

Peculiarities of the isolation: amphetamines extracted by organic solvents from aqueous alkaline solutions.

Qualitative analysis. Phenylalkylami-nes (ATS) (Tables 2, 3).

Table 2. Colour tests of qualitative analysis of phenylalkylamines.

Source: Welchinska, 2017.

***Colour tests:* with Marqui's reagent, with Simon's reagent, with Chen's reagent, with gallic acid**
With Marqui's reagent test – allows the distinction between amphetamine and its ring-substituted analogues
With Simon's reagent test – for secondary amines (methamphetamine)
With Chen's reagent test – amphetamine, methamphetamine, *MDA, MDMA* do not react with Chen's test reagent, but it used to distinguish ephedrine, pseudoephedrine, norephedrine
With gallic acid test – provides a simple means for the distinction of *MDMA, MDA, MDEA* from amphetamine or methamphetamine. It reacts specifically with methylenedioxy substituted aromatic compounds

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Table 3. Peculiarities of colour tests of qualitative analysis of phenylalkylamines.

Source: Nizhenkovska, Welchinska & Kucher, 2020.

Reagent	Amphetamine	Methamphetamine	*MDA*	*MDMA*
Marqui's reagent	An orange, slowly	An orange, slowly	A dark-blue → black	A dark-blue → black
Simon's reagent	—	A deep blue	—	A deep blue
Chen's reagent	—	—	—	—
Gallic acid	—	—	A bright to dark green	A bright to dark green
For compare: ***ephedrine*** gives test with Chen's reagent – a purple colour				

Anion tests (the solubility of compounds and their salts in water and solvents systems) (Table 4).

Microcrystallographic reactions:

– Gold chloride test (5 % HAuCl4 in H3PO4):

D- or L-amphetamines – the microcrystals, resembling long yellow rods or coarse needles and long narrow blades;

DL-amphetamine racemate – at first «oily» drops, after – coloured platy crystals;

D-methamphetamines – the «V» blades with one side shorter than the other side;

L-methamphetamines – a single, crossed blades and «v» blades which form characteristic cigar-shaped ends;

DL-methamphetamine racemate – a single and «X» blades which are sometimes «knife»–shaped;

MDMA – a high birefringed white «X»-shaped crystals with star-like clusters under polarized light.

– Test for optical isomers of methamphetamine (H3BiI4 in H2SO4):

D-methamphetamines – a long orange needles;

DL-methamphetamines – an orange-red rods with slanting ends.

Reactions on primary amino group: the reaction of Schiff's bases formation, the reaction of isonitril formation (Fig. 5).

Table 4. Solubility of phenylalkylamines.

Source: Nizhenkovska, Welchinska & Kucher, 2020.

Amphetamine base: slightly soluble in H_2O, methanol, ethanol, diethyl ether, chloroform
Amphetamine hydrochloride: soluble in H_2O, methanol, ethanol, chloroform; insoluble in diethyl ether
Amphetamine phosphate: soluble in H_2O; slightly soluble in methanol, ethanol; insoluble in diethyl ether, chloroform
Amphetamine sulphate: soluble in H_2O; slightly soluble in methanol, ethanol; insoluble in diethyl ether, chloroform

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UNIVERSITY SCIENCE

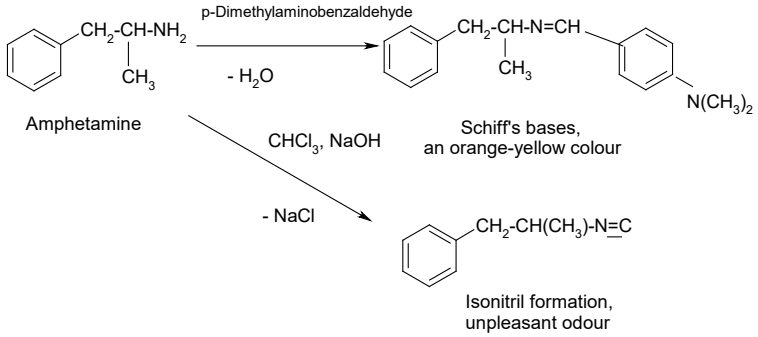

Figure 5. Reactions on primary amino group of Amphetamine.

Source: Welchinska, 2017.

Reactions on benzene ring: the reaction of nitration (Fig. 6).

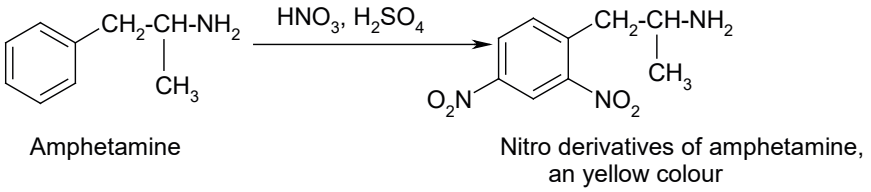

Figure 6. Reactions on benzene ring of Amphetamine.

Source: Welchinska, 2017.

Quantitative determination of amphetamines (*ATS*) is performed by the following physical-chemical methods:

- chromatographic: *TLC, HPLC,* gas chromatography – flame ionization detector *(GC–FID),* gas chromatography – mass spectrometry (*GC–MS),* solid phase-micro extraction – gas chromatography *(SPME–GC),* gas chromatography – Fourier transform infrared spectroscopy *(GC–FIR);*
- spectral: fourier transform infrared spectroscopy (*FTIR),* 1H-nuclear magnetic resonance (*NMR*);
- *capillary electrophoresis (CE).*

Thin layer chromatography (ATS). TLC plates (stationary phases): silica gel G with a layer thickness of 0.25 mm, and containing an inert indicator, which fluoresces under UV light wavelength 254 nm; solvent system or mobile phases (methanol-ammonia conc., 100:1.5; ethyl acetate-methanol-ammonia conc., 85:10:5; cyclohexane-toluene-diethylamine, 75:15:10). *Visualization reagent*: UV light at 254 nm – purple spots on an otherwise green-fluorescent plate; ninhydrin reagent – result in violet or pink spots; acidified potassium iodoplatinate reagent – result in light blue spots; Fast Black K – result in violet to orange or orange-red spots; fluorescamine reagent (Fluram) – result in fluorescence spots.

Gas chromatography – flame ionization detector (GC–FID). Detector: FID (or NPD); column: DB-5 (5 % phenyl 95 % dimethylpolysiloxane), DB-1 (100 % dimethylpolysiloxane); length: 10–30 m, ID 0.20–0.53 mm; film thickness: 0.10–0.50 µm; carrier gas: nitrogen (0.8 ml / min), helium, hydrogen (1–1.2 ml / min for He or H_2); split ratio: 20:1 to 50:1; column temperature: 60–90 °C to 280 °C; injector temperature: 210–250 °C; detector temperature: 310 °C. Identification is accomplished by comparing the retention time of the analyte with that of a reference standard.

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The elution order is as follows: amphetamine < methamphetamine < pseudoephedrine < ephedrine < MDA < MDMA < MDEA < MBDB.

Gas chromatography – mass spectrometry (GC–MS). Operating conditions. GC oven conditions: same as for GC analysis; column: DB-5 (5 % phenyl 95 % dimethylpolysiloxane), DB-1 (100 % dimethylpolysiloxane), 0.25 mm × 30 m × 0.25 *μm*; inlet: mode Split/Splitless (constant flow or pressure), temperature 250 °C, carrier gas helium (1 ml / min); detector: ionisation mode – EI mode, 70 eV (Cl mode if desired), transfer line temperature – 280 °C, ion source temperature – 230 °C, scan parameters – TIC (SIM), scan range 35–450. Identification is accomplished by comparing the retention time and mass spectrum of the analyte with that of a reference standard.

High performance liquid chromatography (HPLC). Operating conditions. Detector: diode array detector (rapid scanning or variable wavelength, UV 200–210 nm); stationary phase: C_8 or C_{18} with 5 μm particle size; column length and diameter: ≤ 30 cm and ≤ 5.0 mm; pre-column: diameter 2–4 mm, length 25 mm, reversed phase C_8 or C_{18}; column temperature 15–35 °C; mobile phase buffer: phosphate buffer pH 2.0–3.2; mobile phase organic modifier: methanol or acetonitrile between 2 % and 20 %; flow rate: 0.1–2.0 ml / min; injection volume 1–100 μm.

Identification is accomplished by comparing the retention time of the analyte with that of a reference standard and by using multiple UV wavelengths or diode array or rapid scanning UV detection.

Capillary electrophoresis (CE). It is similar to *HPLC*, requires no derivatization or extraction steps. In contrast to *HPLC, CE* offers higher resolving power for the analysis of these solutes, which translates into faster analysis.

IR-spectroscopy: in the 800–1600 cm^{-1} region.

^{1}H-nuclear magnetic resonance (*NMR*): enables the analyst to unequivocally distinguish between different ring-substituted amphetamine derivatives; although certain substitution patterns resemble one another in the area corresponding to the protons of the alkyl side chain, the integrated spectrum and the pattern of the aromatic proton singles allow their distinction from one another. Liberate the free base of the *ATS* in situ by the addition of 20–30 mg of solid K_2CO_3 and 0.5 ml CDCl3 and record the spectrum of the free base.

Immunoassays. Radioimmunoassay. Test on reduction of a number of leucocytes.

Antidotes: No antidotes.

Treatment of poisoning by ATS: activated charcoal, benzodiazepines, severe hypertension phentolamin, nitroprusside, Ca antagonists, lidocaine.

After mastering the educational material and based on the results of the research (situational tasks), a laboratory report is compiled and a workbook is filled in. The laboratory report includes the following sections:

- introduction, purpose, objectives of the study;
- justification of the method (methods) used to perform the tasks;
- methods of processing the obtained data;
- results and description of the obtained data, characteristics of the objects of chemical-toxicological analysis, characteristics of the specified physico-chemical parameters or properties of the tested substances;
- discussion of the results obtained, their correspondence to the goal and hypothesis that were the reason for the beginning of the research;
- conclusion on the general result of the learned theoretical material and the per-

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formed practical work and their correspondence to the theoretical materials of literary sources.

CONCLUSIONS

Using the Case study method, we have built an algorithm for learning theoretical material and conducting research on situational tasks of objects of chemical and toxicological analysis of highly toxic substances of phenylalkylamines using the design of single and multiple studies with the identification of «anomalies» and conducting parallel/sequential studies with the comparison of results.

The selection of a large number of objects – derivatives of phenylalkylamines provided a high expected increase in information and results.

The assimilation of the material is carried out according to the following plan: representatives of the group and the peculiarity of their chemical structure, toxicological significance and symptoms of poisoning, objects of study, metabolic pathways and metabolites (active, inactive), isolation methods from objects of study, methods of qualitative detection and quantitative determination of phenylalkylamines, antidote and effective therapy.

Sections of the laboratory report and workbook are filled in based on the results of the work performed.

AUTHOR CONTRIBUTIONS

Conceptualization: Olena Welchinska.
Data curation: Olena Welchinska.
Formal analysis: Iryna Nizhenkovska.
Funding acquisition: Iryna Nizhenkovska.
Investigation: Olena Welchinska.
Methodology: Olena Welchinska.
Project administration: Iryna Nizhenkovska.
Resources: Olena Welchinska.
Software: Iryna Nizhenkovska.
Supervision: Olena Welchinska.
Validation: Olena Welchinska.
Visualization: Olena Welchinska.
Writing – original draft: Olena Welchinska.
Writing – review & editing: Olena Welchinska.

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University science

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NUTRIENT STATUS OF PRE-SCHOOL CHILDREN UNDER CONDI-TIONS OF RADIOECOLOGICAL MONITORING AND A MEGACITY

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ABSTRACT

Modern preventive medicine focuses on the development and implementation of effec-tive large-scale measures to optimize the qualitative and quantitative composition of dietary in-take. Given contemporary environmental conditions, such as soil contamination by pesticides, heavy metals, and radionuclides, continuous monitoring and correction of food components are essential. The aim of this study was to investigate the prevalence of polyhypovitaminosis and mineral deficiencies in pre-school children living in areas with varying degrees of radioac-tive contamination and iodine deficiency (using Ivankiv District and the city of Kyiv as exam-ples).

In the examination of the children, the spectral-dynamic method ("KSK-BARS") was utilized to assess vitamin and mineral status, the biochemical method (iodometric urine analy-sis) was used to determine iodine excretion levels, and statistical analysis methods (t-test) were applied. As a result, new data were obtained regarding the combined deficiency of fat-soluble vitamins and essential trace elements in children living under conditions of chronic low-dose radiation exposure and endemic iodine deficiency. A high prevalence of polyhypovitaminosis was established in both groups, specifically deficiencies in vitamins A (77.0%), E (73.0%), and D (46.2%) among children in the Ivankiv District. A critical level of iodine deficiency was identified: in 80% of children in the Ivankiv District and 44.5% of children in Kyiv, iodine excretion rates were below the physiological norm. The presence of complex poly-deficient states (A–B1–B2–B6–B9–D–E) was confirmed.

Keywords

Pre-school children; polyhypovitaminosis; trace elements; mineral deficiency; radioactive con-tamination; iodine deficiency.

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INTRODUCTION

Rational nutrition is one of the key factors in ensuring health and preventing diseases across all age groups. This is particularly relevant for young children, who are characterized by intensive growth and development processes, as well as reduced resistance to the influence of adverse environmental factors, specifically radioactive contamination (Serdyuk, 2018).

A deficiency or imbalance of essential substances in the diet leads to the development of nutrition-related diseases. Deficiencies in vital food ingredients such as iodine, vitamin A, and iron constitute a global public health problem due to their significance and prevalence (Matasar et al., 2020). The Ukrainian Polissya, specifically the Ivankiv District, is characterized not only by radionuclide contamination resulting from the Chornobyl disaster but also by insufficient iodine content in the environment (Matasar et al., 2020; Matasar, Petryshchenko, & Chernyshov, 2020).

LITERATURE REVIEW

The problem of micronutrient deficiency remains one of the most pressing issues in modern medicine. According to WHO data, deficiencies in iodine, vitamin A, and iron are recognized as global threats, which are particularly critical during childhood (Matasar et al., 2020). Current research in Ukraine indicates that children's health status is formed under the combined influence of adverse factors: environmental pollution and unbalanced nutrition (Serdyuk, 2018).

Chronic exposure to low doses of radiation places increased demands on the body's antioxidant system, the key elements of which are vitamins A, E, C, and trace elements Se, Zn, and Cu (Matasar, Petryshchenko, & Lutsenko, 2019; Petryshchenko et al., 2021). Fat-soluble vitamins play a crucial role in maintaining homeostasis under conditions of environmental distress. Specifically, vitamin D deficiency in Ukraine has reached pandemic proportions (Matasar, Petryshchenko, & Lutsenko, 2019). The lack of B-group vitamins also significantly reduces the adaptive potential of residents in affected regions (Matasar, Petryshchenko, & Chernyshov, 2020).

Modern data suggest that classic iodine deficiency is often complicated by a lack of selenium- and iron-dependent enzymes (Matasar, Petryshchenko, & Matasar, 2021). Despite a significant number of works, comparative studies of the nutrient status of children in rural radioactive-contaminated areas versus megacities remain fragmentary (Petryshchenko et al., 2021).

MATERIALS AND METHODS

A total of 83 preschool children were examined: 26 from the Ivankiv district and 57 from the city of Kyiv. The "KSK-BARS" complex was utilized to assess vitamin and mineral status. Iodine status was evaluated based on urinary iodine excretion levels in 40 children (20 subjects from each group). Statistical analysis was performed using Student's t-test in Microsoft Excel.

RESULTS

A significant prevalence of polyhypovitaminosis was identified in both groups (table 1). The most pronounced deficiencies involved vitamins A, E, D, and B_9.

Table 1. Prevalence of hypovitaminosis among the examined children

Source: Matasar et al., 2020.

Hypovitaminosis	Ivankiv District (n=26), n (abs.)	Ivankiv District (n=26), %	Kyiv (n=57), %
Retinol (A)	20	77.0	45.0

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Table 1 (continued)

Hypovitaminosis	Ivankiv District (n=26), n (abs.)	Ivankiv District (n=26), %	Kyiv (n=57), %
Tocopherol (E)	19	73.0	48.0
Folic acid (B_9)	15	57.7	42.0
Pyridoxine (B_6)	13	50.0	38.0
Calciferol (D)	12	46.2	52.0
Thiamine (B_1)	10	38.5	32.0
Riboflavin (B_2)	10	38.5	30.0
Cyanocobalamin (B_{12})	10	38.5	28.0
Niacin (PP)	8	30.8	25.0
Rutin (P)	8	31.0	22.0
Ascorbic acid (C)	5	19.2	15.0

Complex polyhypovitaminosis (A–B1–B2–B6–B9–D–E) was observed in 11% of children from Kyiv and 19% from the Ivankiv district. Regarding mineral status, iodine deficiency was more pronounced in rural areas (77%), while calcium deficiency was more prevalent in the metropolis (60%) (Matasar, Petryshchenko, & Chernyshov, 2020).

Table 2. Prevalence of hypomicroelementosis among the examined children

Source: Matasar et al., 2020.

Hypomicroelementosis	Ivankiv District (n=26), n (abs.)	Ivankiv District (n=26), %	Kyiv (n=57), %
Iodine (I)	20	77.0	44.5
Iron (Fe)	17	65.4	58.0
Calcium (Ca)	15	58.0	60.0
Sodium (Na)	14	54.0	48.0
Phosphorus (P)	14	54.0	50.0
Zinc (Zn)	10	38.5	35.0
Chromium (Cr)	10	38.5	32.0
Potassium (K)	9	34.6	30.0
Magnesium (Mg)	7	27.0	25.0
Selenium (Se)	5	19.2	18.0
Copper (Cu)	5	19.2	16.5

Urinary iodine excretion results (table 3) confirmed a significant deficiency (Matasar, Petryshchenko, & Matasar, 2021).

The median urinary iodine in children from the Ivankiv district was 62.01µg/L (mild de-ficiency). In 80% of children in this group, iodine supply was below the normal range. In Ky-iv, the median was 103.52 µg/L; however, 44.5% of children also exhibited insufficient iodine levels (Fig. 1).

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Table 3. Urinary iodine excretion rates in preschool children (µg/L)

Source: Matasar et al., 2020.

Group	Mean (M±m)	Minimum (M min)	Maximum (M max)
Ivankiv District	62.01 ± 5.63	27.61	115.91
Kyiv City	103.52 ± 6.01	48.75	146.31

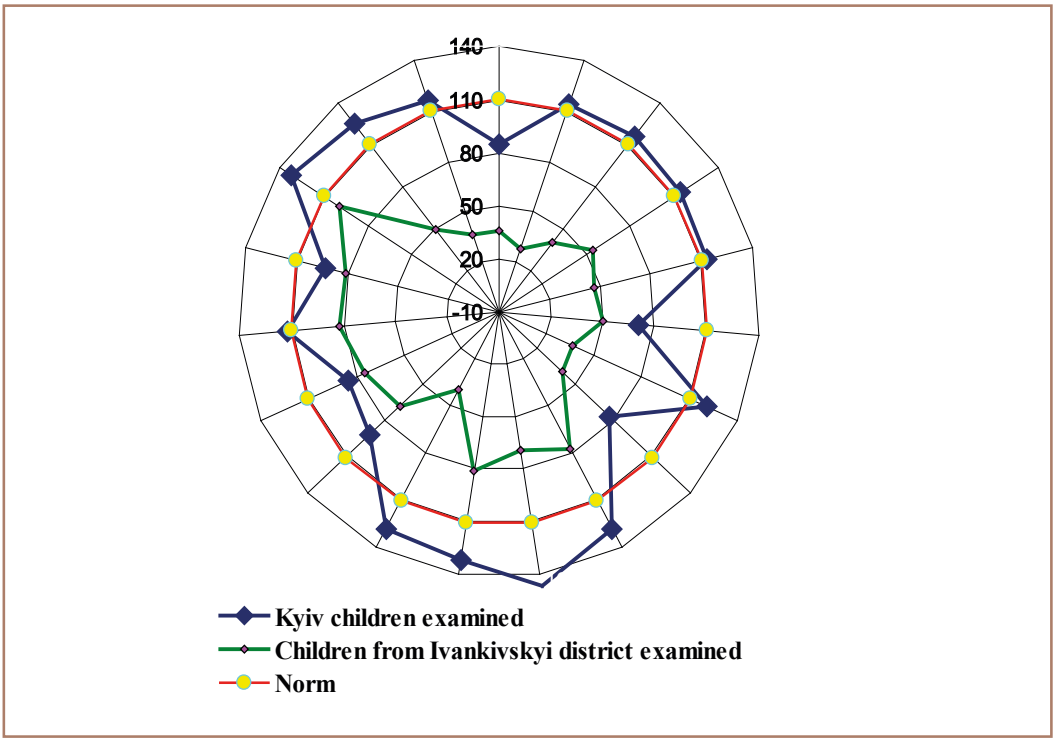

Fig. 1. Indicators of iodine excretion with urine in examined children, (µg/l)

The median urinary iodine in children from the Ivankiv district was 62.01µg/L (mild deficiency). In 80% of children in this group, iodine supply was below the normal range. In Kyiv, the median was 103.52 µg/L; however, 44.5% of children also exhibited insufficient iodine levels (Fig. 1).

DISCUSSION

The results obtained indicate systemic nutritional disorders in both regions. Deficiencies in vitamins A, E, and D are critical for immune defense and the development of the nervous system (Matasar, Petryshchenko, & Lutsenko, 2019). Of particular concern is the combination of iodine deficiency with the radiation background, which increases the risk of thyroid pathologies (Matasar, Petryshchenko, & Matasar, 2021). State measures (such as salt iodization) may be insufficient without the correction of concomitant micronutrient deficiencies required for hormone metabolism.

CONCLUSIONS

1. Widespread polyhypovitaminosis, particularly regarding vitamins A, E, D, and B9, was identified in children of both groups.
2. Iodine deficiency affects 80% of children in the Ivankiv district and 44.5% of children in Kyiv, necessitating immediate correction.
3. It is necessary to implement comprehensive nutrient support programs, especially in radioecological control areas.

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University science

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UNIVERSITY SCIENCE

DIVERSIFICATION OF RURAL TOURISM IN UKRAINE ON THE BASIS OF EUROPEAN EXPERIENCE

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ABSTRACT

It is established that in many countries rural green tourism (RGT) is considered one of the leading areas of development of the national tourism industry, which is reflected in national concepts of tourism development. Different concepts of rural green tourism with different goals have been studied. It is determined that the task of international socio-economic programs to move part of the agricultural population from production to services is to encourage the development of agricultural regions and their populations by organizing a new specific sector of the local economy. The performed analysis of foreign experience shows the high importance of integration of different types of tourism with rural and green tourism for the success of its development. The concepts of GRT development management are generalized taking into account Western European, Eastern European, English-American and Asian models in order to form national priorities. It has been established that the expansion of tourism in rural areas causes many changes in different areas, in particular, it concerns changes in the land use, the functioning of infrastructure, the structure of employment, the position of the region in the network of settlements. Models of development of green and rural tourism are systematized taking into account foreign experience. The main reasons that led to the great popularity and expansion of rural green tourism in Europe and in the national economy have been identified. The concepts of management of rural green tourism development are offered and proposals on ensuring the priority directions of rural green tourism progress in Ukraine and its approximation to EU standards are suggested.

Keywords

Rural green tourism, concept, principles, consumers, services, tourists, tourism, development, integration, success, sector, specifics.

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ANALYSIS OF RECENT INVESTIGATIONS AND PUBLISHED PAPERS

In the works of foreign scientists the problems are considered and the expediency and necessity of diversification of rural tourism in European countries are substantiated. The mentioned issues have been studied by the following scientists: Richard Abrahams (2019), Çiğdem Kaptan Ayhan (2020), Liping A. Cai (2020), Maria João Carneiro (2018), Ming-Hsiang Chen (2021), Xiaoting Chi (2020), Xueting Dou (2020), Jose Antonio Salinas Fernández (2019), Jing Gao (2017), Heesup Han (2021), Dimitri Ioannides (2020), Elisabeth Kastenholz (2018), Jiangfeng Li (2020), Yiping Li (2019), Chunyan Liu (2020), Sandra Maria Correia Loureiro (2018), Carlos Peixeira Marques (2018), José María Martín Martín (2019), José Manuel Guaita Martínez (2019), Helena Mogorrón-Guerrero (2019), Mondéjar-Jiménez J. (2017), Ferah Özkök (2020), Sáez-Martínez (2017), Milada Šťastná (2020), Ching-Hui (Joan) Su (2021), Hasan Tatlı (2020), Tülay Cengiz Taşlı (2020), Antonín Vaishar (2020), Villanueva-Álvaro J.-J. (2017), Fang WT (2020), Bihu Wu (2017), Yin Zhi, Jianchao Xi (2018), Jonathan Moshe Yachin (2020), Jun Yang (2018), Ruxin Yang (2018), Dian Zhang (2020), Heqing Zhang (2019). It is the study of the experience of European countries on the development of rural green tourism that allows the development of this type of tourism industry in Ukraine. Development of rural green tourism in Ukraine on the basis of European experience allows to solve many social issues. Therefore, the research topic is relevant and timely.

The aim of the article is to study the experience of European countries in order to diversify rural green tourism on the basis of sustainable development.

RESEARCH METHODS

The use of the method of generalization and scientific abstraction, analysis and synthesis made it possible to study the experience of European countries and make specific proposals for the diversification of rural green tourism on the basis of sustainable development. The use of methods of historical and logical thinking made it possible to characterize the models of development of green and rural tourism and suggest ways to improve them. The combination of empirical, graphical and tabular methods made it possible to form four concepts for managing the development of rural green tourism.

RESULTS

At the global level, there is still no single common system for the development of rural green tourism, although there are a number of generally accepted principles and approaches to implementation. As rural tourism is developing quite dynamically abroad and represents a significant sector of the tourism industry, it is advisable to conduct a study of the practice of its infrastructure development abroad in order to determine the most successful approaches to rural green tourism development. There are several different concepts of rural green tourism with different purposes. At the same time, in many countries rural green tourism is considered one of the leading areas of development of the national tourism industry; it is reflected in national concepts of tourism development.

International practice shows that the development of rural green tourism in the form of a small family hotel business is a large socio-economic program to move part of the agricultural population from production to services. Its task is to encourage the development of agricultural regions and their populations by organizing

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a new specific sector of the local economy. In addition to economic, such public policy pursues social and socio-cultural goals: to stop the degradation of rural areas, the outflow of population and the growth of negative social phenomena, to preserve and reproduce partially cultural heritage and national identity.

The EuroGites, the European Federation of Rural Tourism data show that over the last 10-15 years the average annual growth rate of rural tourism was 10-15%, which is much higher than for European tourism in general (4-5%) (Shchetinina, 2013).

Regarding the portrait of rural green tourism consumers in Europe, EuroGites experts note the following characteristics (Shchetinina, 2013):

- 95% of tourists are domestic, 80% of them live less than three hours transport accessibility;
- the average length of stay is from 1.5 days (local market), 3,6 days (4 hours of transport accessibility) and about 8 days (foreign tourists);
- the most popular rooms are with a minimal set of services or without them at all;
- more than 80% of visitors prefer independent living.

Models of development of green and rural tourism are given in table. 1.

Table 1. Models of green and rural tourism development

Source: Generalized by authors based on (Implementation of the European experience of sustainable rural tourism and creative industries complementary development, 2023)

French model	1) Different forms of classic rural green tourism, varying depending on the proximity to the sea; 2) considerable attention is paid to the development of gastronomic and wine tourism; 3) forms of accommodation of tourists assume living on farms to a lesser extent, tourists are accommodated in cottages.
German model	1) Accommodation and meals in farmhouses; 2) rural green tourism is intertwined with farming and event tourism; 3) work on the ground is assumed.
Italian model	1) Rural green tourism is combined with the restoration of health, the study of gastronomy and local products, sports; 2) accommodation of tourists in apartments; 3) tent camps are common.
Czech model	1) Focused on production regions and regions bordering protected areas; 2) is a budget type of recreation; 3) accommodation in farmhouses with elements of authentic rural life.
Spanish model	1) Widespread rest in the village, on the farm; 2) acquaintance with farming, gastronomy, animal care.
Polish model	1) Distinguished by a clear distinction between «tourist» farms: for some it is the main and only business, for others it is additional income; 2) accommodation facilities differ in cost and quality of services provided.
Latvian model	1) Rest with elements of traditions and customs on farms.

Thus, in France the share of rural green tourism in the tourist flow reaches 33%, in the UK it is about 10% of entrepreneurs working in rural areas, in Germany it is slightly less than 4% of entrepreneurs serving up to 13% of the domestic tourism market (Shchetinina, 2013).

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The success of rural green tourism, which among countries has begun to transform from an ancillary agricultural sub-sector to an independent and competitive service sector, has contributed to purposeful development in various countries around the world. Thus, we can identify the following four concepts of managing the development of rural green tourism (fig. 1).

Thus, the analysis of foreign experience shows the high importance of

integration of different types of tourism with rural and green tourism for the success of its development.

Concepts of management of green and rural tourism development	Western European - the emphasis on the environmental aspect.
	Eastern European - the emphasis on recreation in rural areas, in which the main role is played by systemic state support for the development of green and rural tourism.
	Anglo-American - the emphasis on inexpensive accommodation in the countryside.
	Asian - the emphasis on the demonstration of elements of national culture.

Figure 1. Concepts of management of green and rural tourism development

Source: Generalized by authors based on (Ivanyshyn, & Dudziak, 2016).

From the point of view of society, the processes of urbanization are manifested by population growth, which uses the standards of urban lifestyle.

Today, the global trend is that more than half of the world's population lives in cities. This share will continue to grow according to forecasts. Even today, there are countries on the world map in which 100% of the population lives in cities. These are Monaco, Hong Kong, Singapore, Bermuda, St. Martin, Macau and the Cayman Islands.

The expansion of rural tourism is causing many changes in different areas, including changes in land use, the functioning of infrastructure, the structure of employment, the position of the region in the network of settlements.

Such changes are related to the flow of capital from the city to the countryside. Urbanization processes have different directions, which are interconnected and interdependent. These are: economic, spatial, demographic, and cultural. Tourist urbanization often covers attractive natural areas and occurs differently in certain areas. It depends mainly on the intensity of tourist flows.

France and Spain play a leading role among the countries in the development of green and rural tourism, in these countries tourism has become a highly profitable industry at the level of international specialization.

Today, the European Federation of Rural Tourism which unites national rural tourism organizations in European countries, has been established to promote the development of green and rural tourism and attract investment in this area.

It is known that more than 56% of the populations in the 27 member states of the European Union live in rural areas, covering 91% of the EU territory (Cherep, Cherep, Krylov, & Voronkova, 2019).

Among the main reasons that led to the great popularity and expansion of green and rural tourism in Europe are the following: reduction of the share of the agricultural sector in the national economy (today this figure in the EU is 5%, while in Ukraine the share of agricultural production in GDP grows to 10.7 %); increasing the level of urbanization of the population; aggravation of the ecological situation; deterioration of food quality.

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The purpose of forming the strategy of green and rural tourism development in Ukraine is to create a competitive tourism product capable of ensuring the socio-economic development of the territory, satisfying the needs of the population in recreation, taking into account the principles of sustainable development.

Research in this area suggests that rural green tourism can be one of the ways to diversify the economic development of rural areas, curb the demographic decline and solve the burning issues in the region.

Today, an average of 31.1% of the rural population lives in Ukraine. In the western region, these figures are much higher. This requires the government to take urgent measures to ensure the development of rural areas and communities. Such steps must be aimed at diversifying the economy and developing those industries that must attract labor forces.

For Ukraine rural green tourism can become a real area for diversification of rural residents' activities. Given the socio-economic conditions prevailing in our country, the following options for the development of rural green tourism may be the most optimal: develop the studied service sector based on available resources or through the construction of new or re-equipment of old facilities, taking into account modern building codes, consumer needs, as well as areas of tourist consumption.

In addition, you can use foreign experience and develop rural green tourism in areas of specialization.

We see the strategic direction of rural green tourism development in Ukraine in its specialization on the creation of an integrated tourism product, the peculiarity of which will be that consumption will be based solely on organic products produced in rural areas in addition to traditional proposals.

As we can see from the above material, rural green tourism in Ukraine is developing independently and chaotically, using its own available resources, without attracting investment. We should not expect drastic changes in the direction of improving socio-economic indicators in this situation. For the effective development of rural green tourism in Ukraine, it is necessary to develop a Strategy for the development of rural green tourism, the basis of which should be clustering on a territorial principle. There is no doubt that each region of Ukraine is unique and can determine its specialization. It would be advisable to involve small agricultural producers in rural green tourism clusters, as this would strengthen significantly the competitive position and allow small producers to sell at stable prices and receive real sales channels.

CONCLUSIONS

Although rural recreation in Ukraine has a long history, its future is still unclear. It is unknown today whether this type of recreation will become a full participant in the national tourism market. It is possible that in the absence of an effective state policy in this area, rural recreation will remain in a semi-legal status, without a clear organizational structure, without information and marketing activities at the appropriate level, simply as a type of application in other areas of tourism.

Rural tourism is a promising type of tourism industry in today's economic and demographic conditions, it can really help small settlements in Ukraine to survive, because small villages are what attract visitors with their specifics.

In order to ensure the priority of rural green tourism development in Ukraine and its approximation to EU standards, it seems appropriate:

- to simplify the regulatory framework by adopting by the Verkhovna Rada the Law

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"On Rural Green Tourism" and the Resolution of the Cabinet of Ministers on the standardization of its activities "Tourist services. Rural green tourism. Primary requirements";

- to develop regional rural green tourism development programs with their integration into the Rural Green Tourism Development Program in Ukraine, which must be approved by the Government;
- to determine the methodology for developing and implementing monitoring of the achievement of targets for these programs at the regional and national levels;
- to complete the reform of the national statistics system, realize its technical re-equipment, in particular to ensure the creation of electronic monitoring systems for regional and national rural green tourism development programs;
- to create an infrastructure of state financial and credit support for the development of rural green tourism;
- to organize research on the needs of the market of rural green tourism services for specialists and regulate the number of their recruitment in higher education institutions on the basis of the state order in the target areas of the region;
- to create a system of information and analytical support for the tourism sector, including rural green tourism, as part of the state information system.

Each of the above directions of ensuring the priority of rural green tourism development in Ukraine should strengthen the regulatory function of the state. It should be based on the results of previous development studies.

The implementation of the proposed recommendations will promote mutually beneficial cooperation between the subjects of the rural green tourism market in the region and local authorities, environmental protection, as well as sustainable development of rural areas.

Thus, at the present stage, rural green tourism remains a highly promising sector of the tourism sector, is important for the Ukrainian economy, attracts not only domestic tourists but also from many countries, promotes foreign economic relations with various countries.

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UNIVERSITY SCIENCE

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University science

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FORMATION AND DEVELOPMENT OF INNOVATION ACTIVITY AREAS AT THE INDUSTRIAL ENTERPRISE

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ABSTRACT

It is established that the economic mechanism of innovation activity (EMIA) interacts with other mechanisms of the enterprise, which indicates the feasibility of economic mechanism (EM) development and application or improvement in accordance with the enterprise's needs. The economic mechanism of innovation activity (IA) of industrial enterprises is suggested, given the formation subsystems and activity areas development. The subsystems of the economic mechanism for formation and development of industrial enterprises' innovation activity are characterized. Among EM objects, there were determined the following ones: the process of EM development; organizational, technical, administrative decisions with regard to the production process; business operations; technological developments, equipment; social atmosphere in the team; R&D, production of innovative goods; raw materials and their processing; reach of new markets for sales and goods promotion; innovation activity implementation; functioning of the enterprise's units; selection of activity type. It is determined that the EMIA goal is to form and develop the areas of innovation activity, with the most promising and appropriate ones in terms of innovation being defined, given influence of various factors. As well, the EMIA aims at definition of the needs for innovation involvement, creation of employees' interest in IA execution, application of the latest innovative technologies, development and promotion of innovative equipment on the market, manufacture of transport products, equipment for cars, spare parts, ensuring coherence across all EM subsystems, compliance with all the components, rational economy management, R&D, employee welfare and long-term goals achievement.

Keywords

Economic mechanism, innovation activity, subsystem, objects, subjects, formation, development, goal, functions, areas.

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ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

Innovation activity is a tool for ensuring a high level of competitiveness and viability of enterprises. There is a need to harmonize the impact of various tools for managing innovation activities. The problematic issues of such harmonization were studied by domestic and foreign scientists, namely: Chaplinsky V.I. (2020), Komarnicka N.M. (2016), Lucikiv I.V. (2010), Khrapkina V., & Mohylnyi Y. (2023), Kosenko O.P. (2015), Kravchuk A.V. (2018), Martynenko A.V., Pererva P.H. (2019), Maslak O.O. (2012), Ohrenych Y.O., Helman V.M. & Gorbunova A.V (2024). Tkachenko P.V. (2021), Voynarenko, M.P., Cherep, A.V. (2019, 2024), Gonchar, O.I., Cherep, O.H. (2019, 2024), Krylov, D.V.& Oleynikova, L.H. (2019).

In the above-mentioned studies, scientists investigated innovative progress in the state as a basis for transformational changes at a time of significant losses and challenges. The emphasis was placed on the importance of state support for domestic knowledge-intensive industries and innovative projects to attract strategic investors, on the creation of appropriate conditions for the functioning of small and medium-sized businesses, and the development of investment mechanisms for combining public and private capital to finance innovative entrepreneurship. But the study of the feasibility of intensifying innovation activity during the Russian-Ukrainian war is extremely important Angel E.I. (2024), Bila I.S., Posna V.S., Shevchenko O.O. (2023), Perminova, S., Sytnyk, N., & Chuprina, M. (2024), Yatskevich I.V. (2023). But in the conditions of the russian-ukrainian war, it is possible to intensify innovation activity only through the use of an economic mechanism, so we consider it expedient to offer it to a wide range of economists. Therefore, the topic is relevant today and will be timely in the future.

During the development of the information society, information becomes not only the main means of increasing the competitiveness of the enterprise, but also the main source of cooperation and collaboration among enterprises. Moreover, the exchange of knowledge is possible not only among enterprises, but also directly from the enterprise to customers. Means of knowledge exchange are used by 5786 enterprises for 2024, with a tendency to increase in the following periods.

In order to spread mobile and Internet communication, to control the quality and speed of services provided, the Ministry of Digital Transformation of Ukraine created the Broad-Band project (Perminova, Sytnyk, & Chuprina, 2024). On the project site, each user can provide location data and the program automatically measures the speed of the Internet. The site should check the availability of services throughout the country, their speed and, as a result, the collected data should become a prototype of the Internet map of Ukraine.

The aim of the article is to development of an economic mechanism of innovation activity of industrial enterprises on the basis of taking into account subsystems and directions of development activities.

RESEARCH METHODS

The use of methods of generalization of the subsystems of the economic mechanism made it possible to form EMIA, which made it possible to improve its development and application, as well as to establish investment activity at an industrial enterprise, provided that they are consistently applied. The use of methods of induction and deduction made it possible to identify the relationship between the subsystems of the economic mechanism and to develop specific recommendations for increasing the investment activity of industri-

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al enterprises. The combination of historical and logical methods of research made it possible to determine the directions for improving innovation activity, increasing the pace of scientific and technological development, creating a preferential system of crediting, reducing tax pressure, implementation of innovations at the regional and managerial levels, development of the country's innovation potential and cooperation with foreign companies.

RESULTS

The economic mechanism consists of the subsystems which are interlinked and enable improvement of economic mechanism development and application as well as establishment of investment activity at an industrial enterprise, provided that they are applied in the preassigned order (Fig. 1).

The first EMIA subsystem is a subsystem for IA process implementation and management, where the IA objects and subjects are determined. The economic mechanism subjects are executives, persons responsible for the mechanism development and those, who execute IA (unit of IA implementation, marketing unit), allocate financial resources to development of innovation and investment projects, state and local authorities, investors, creative teams, inventors, managers.

The main objective of the given subjects is to develop an effective EM, assess the possibility of its application with the view of IA improvement, validity of responsibilities assignment and managerial decision-making.

They are also responsible for distribution of powers, expenditure of financial resources, use of investment capital, innovative technologies, amount of profits made and EMIA efficiency.

At the same time, employees should improve their knowledge, skills and abilities in order to conduct research. In their turn, managerial staff should create conditions for improvement of employees' skills.

The next subsystems are target and operation ones. Their activities are related to goal setting, definition of tasks, application of principles and methods, adherence to the functions. When determining the EMIA aim, it is necessary to take into account the overall goal of the enterprise's activities, IA prospects as well as its innovation and investment potential.

The mechanism application is aimed at performance of the following tasks: research of the market environment, consumer behaviour; selection and justification of IA areas; identification of prospects for IA development; satisfaction of consumer needs and forecast of feasibility of new goods production; efficiency of EM application in activities of industrial enterprises; determination of the level of IA state regulation and the need for financial support; reduction of risks affect, IA improvement provided that the information is available; R&D works; feasibility of innovative industrial goods production; adoption of advertising measures to distribute the product; involvement of additional funding sources, i.e. search for investors, sponsors; time parameter of EM application; establishment of relations between the enterprise and state, region; identification of needs and interests of business entities.

The subjects of innovation activity fulfil their obligations based on application of methods, principles and functions. The main functions of the leadership include planning, implementation, motivation and control. Besides, in the process of innovation activity implementation, the enterprise's unit responsible for this process performs the functions of coordination, analysis of development of the

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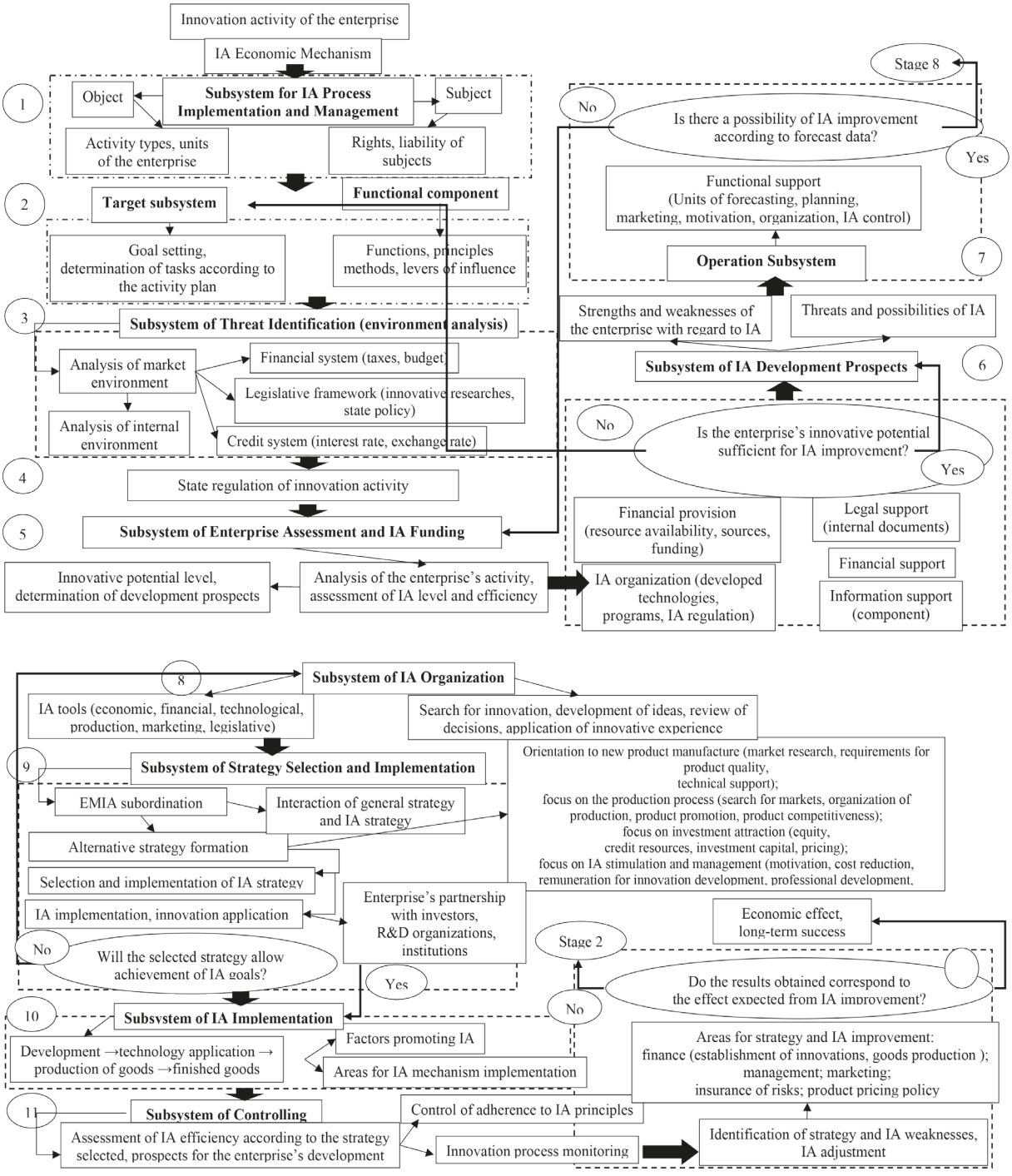

Fig. 1. Economic mechanism of industrial enterprise's innovation activity

Source: Developed by the authors base on (Korsikova, 2009; Kreidych & Nakonechna, 2014; Kreidych, I.M., Nakonechna and Shvets, 2013; Marchenko, E. S. (2015). Priadko, 2017; Savina, 2015; Savchenko & Soloviou, 2013).

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market for advanced technologies, research of the enterprise's position, identification of more effective areas for IA, forecasting, evaluation of results and alternatives for IA improvement, monitoring, information awareness (that is, receipt of information from external environment, awareness of all the EMIA subsystems, exchange of information between management and departments). The EMIA formation is based on the application of principles, among which there are the following: system; consistency; complexity; alternativeness; orientation to IA; balancing of interests; satisfaction of needs; integrity; adaptability; risk assessment; cyclicality; development; internal and external substantiation. At the same time, the methods of EM implementation allow adjustment of its development process, effective application of this mechanism in the enterprise's activities by observing certain rules for IA development and enterprise operation as a whole. The main methods include as follows: taxation; regulation at the state and regional level; state support; motivation; insurance of IA; risk minimization; financing; planning; organization; price regulation; adjustment of demand for products; social methods; forecasting; marketing and management; control.

The following EMIA subsystem is the subsystem of threat identification (environment analysis), which provides for study of external and internal environment with the aim of identification of threats and risks of the enterprise's operation, obstacles to successful innovative development, stability, innovation. The enterprise's unit responsible for IA and EM development should investigate and analyse the impact of market environment factors, since they can have a stimulating effect on the EMIA application or, conversely, slow down this process. Account of environmental factors' effect is taken in order to adapt to the influence of the identified factors, adjust the enterprise's IA and determine the impact of the state and regional levels on innovative development. In particular, innovation policy at the regional level is aimed at application of innovations in order to solve problems related to the use of resource potential, raw materials, labour resources and saturation of the domestic market with necessary goods. Among the factors of external environment, the following factors have a more significant impact: legislative framework, legal regulation of innovation activities; the country's financial system, that is, tax pressure, tax benefits for businesses, loans provided by state and commercial banks, political system, insurance mechanism and the level of international cooperation. Taking into account the influence of internal factors makes it possible to increase IA efficiency, evaluate the enterprise's market opportunities, develop new technologies, manufacture products and sell them on the foreign market in order to improve economic development. Among the internal factors, the following ones were identified: enterprise's interaction with financial and credit institutions; organization of industrial goods production, provision of services; current management system; functioning of units; product range; frequency of innovative technologies use; innovation and investment potential; financial opportunities for innovation application and innovation projects implementation; system of distribution, use of financial resources; needs and interests of management and consumers with regard to innovative goods production; level of equipment obsolescence and use of energy-efficient technologies.

A significant role is played by the process of state regulation of innovation, which occurs at stage 4 and takes a prominent place in establishment of enterprises through eco-

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nomic mechanism application. In particular, state regulation is manifested in IA promotion based on creation of innovation funds, provision of tax benefits, reduction of rates on loans, price regulation, R&D funding, improvement of social welfare, of legal and political regulation, awakening of enterprise leadership's interest in innovation application on condition of creation of innovative development programs and provision of financial support. In addition, state support for IA development creates opportunities for enterprises to participate in international fairs for presentation of their technological achievements and research of innovation products, and is aimed at innovations dissemination in various activity areas for the purpose of their research and application in practice. It is the state regulation process that will allow enterprises to use innovative developments in the production process, evaluate the effectiveness of these developments and promote innovations dissemination.

Subsystem 5 of the economic mechanism is assessment of the enterprise and IA funding, which involves analysing financial results of activities and the existing level of innovation activity efficiency in order to collect, process and analyse information at the level of financial stability, solvency, business activity, economic development, investment activity and competitiveness, which allows drawing conclusions on the achieved level of innovative development and the need to improve it by IA strategies application. At the same time, in order to apply innovations, the enterprise's financial backing, R&D, access to information and possibility of its use, effectiveness of internal standards, rules and regulations with regard to IA control are assessed, availability of state financial support and the need to involve it are determined, the process of IA organization and implementation as well as efficiency of this process are analysed. In addition, the IA unit evaluates the enterprise's innovative potential, determines the development prospects and, in case the innovative potential is sufficient for IA development, it proceeds to the next subsystem. However, in case the results obtained are negative, it returns to the target subsystem.

The next EMIA component is the subsystem of IA development prospects, which involves identification of the strengths and weaknesses of IA development, threats and possibilities for its improvement as well as regulation of the enterprise's operation. This analysis will allow evaluation of possibilities, identification of the need to improve the process of innovations involvement, to develop, adopt and promote technologies, assessment of the enterprise's readiness for innovative development within a specified period of time in accordance with the general activity goals.

Then the transition to the use of the functional component occurs. This stage involves forecasting (it enables assessment of IA prospects, possible results from innovative development increase, forecast of economic effect from the enterprise's activities), planning (determination of areas for the enterprise's development, measures for IA improvement, establishment of necessary resource amount, development of plans for each unit's activity), marketing (research of product sales markets, improvement of image, promotion of an innovative product, creation of demand for an innovative product), motivation (measures to encourage employees to develop new ideas, their implementation into practice, professional development), organization (adoption of measures to improve manufacture of innovative products, application of modern technological developments, attraction of

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additional funding sources), control (monitoring the process of innovation, production, compliance with the rules and regulations of innovation), which are carried out by the relevant units of the enterprise. Based on the diagnostics of IA effectiveness and assessment of the prospects for its improvement in the future, a decision is made to move to the next subsystem.

The IA organization subsystem is implemented at stage 8 and provides for application of tools, since performance of EM functions and compliance with the principles require their application. We should note that the tools are individual for each industrial enterprise and are determined in accordance with operation peculiarities, interests of entrepreneurs, managers, employees, and existing needs. The EMIA tools included economic, financial, technological, production, marketing, and legislative ones. The peculiarity of economic tools is that they take into account the aspects of the enterprise's economic development, its interaction with regulatory state authorities, peculiarities of financial resources' distribution, shape the areas of their allocation and allows organization of the innovation process given the following components: establishment of industrial production efficiency; the process of innovative risks insurance of industrial enterprises; size of liability to tax; adjustment of prices for products and services; the enterprise's orientation towards innovative development. The application of financial tools determines the enterprise's financial capacity of innovation activity development, ability to finance R&D, and helps attract additional financial sources to improve IA. This group of tools includes as follows: the crediting mechanism for enterprises; financial resources; amount of equity and debt capital; amount of accounts payable; amount of investment resources; expenditure on various activities; funds allocation to IA; financial support of the state and regional authorities. Technological tools are necessary for formation of a technical base for innovative technology development, ensuring of the production process, improvement of innovative development and IA areas. They include analysis of innovative technology development; innovative market research; assessment of effectiveness and feasibility of technological developments application; research; improvement of technologies; introduction of scientific developments in production activities; production of qualitatively new products. The production tool application is necessary for application of the developed technologies in manufacture of new products, which is a prerequisite for improvement of innovation activity efficiency, growth of performance indicators and confirmation of the feasibility of innovation adoption in the enterprise's activities, provided that the product is successfully sold. These tools include as follows: availability of raw materials and stock; depreciation of fixed assets; production technology; the share of obsolete equipment; automation and energy intensity of production; creation of better products; environmental friendliness of products. The importance of marketing tools lies in the possibility of directing innovation activities, creation of innovations and their distribution in the foreign market as well as creation of additional conditions for improvement of innovative development effectiveness. Among the marketing tools there are the following: improvement of the product properties; development of a new product; determination of sales terms for the product manufactured; promotion of innovative products to the market; studying of consumer demand and needs

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for new product manufacture; improvement of the enterprise's image; advertising events to spread information about product advantages. The importance of legislative tools consists in legal regulation of innovation activity, definition of the rules to follow when it is implemented, which will improve this activity organization. Among the legislative tools there are as follows: legal acts, provisions of the current legislation, state control and innovation policy, international programs of innovative development, regional authorities' policy with regard to IA, internal orders, rules, norms and instructions of the enterprise. The application of the above tools will allow searching for innovations, use of foreign firms' experience of innovative technology application, improvement of the process of new ideas development by employees and identification of more effective innovative technologies.

Based on the use of the selected tools group, it is possible to use IA strategies and make changes to the selected strategies. The subsystem of strategy selection and implementation occurs at stage 9 and consists of a group of interrelated stages, namely: determination of correspondence between the general strategy of the enterprise's development and the shaped IA strategy, comparison of goals, tasks and means to achieve them; the process of alternative strategies shaping aimed at new products manufacture, production process establishment and its modernization, raising investment capital for innovation activities, IA stimulation and management to improve innovative development; selection and adoption of a more effective IA strategy, that is, a strategy that has significant advantages over others and will provide the expected effect; involvement of innovation and IA realization based on application of the strategy and innovative potential; establishment of cooperation between the enterprise and research organizations with the aim of R&D and staff training staff. The application of the selected IA strategy should contribute to the achievement of innovative goals, which will allow transition to the next subsystem. However, if the situation is reverse, there is a possibility to return to the subsystem of IA organization.

The penultimate subsystem is IA implementation, which is necessary for development of technologies, innovative equipment, methods of production process organization, transition to these developments' application in the enterprise activities, process of new products manufacture and final result achievement, that is, a product with new properties or a completely new product with no analogues in the market. In involvement, application and dissemination of innovations, the factors that stimulate IA development are taken into account, and areas of IA implementation and EM application are determined. This stage is of importance due to IA execution, which is associated with creation of innovations, goods production and professional development.

At the last stage, the controlling subsystem is used to supervise the process of IA implementation, apply the IA strategy, monitor these processes, identify weaknesses, eliminate shortcomings and correct not only the innovation activity, but also the economic mechanism. At this stage, the IA efficiency is assessed in accordance with the strategy selected, the prospects for the enterprise's operation and possibilities of further application of the economic mechanism are determined. In the EM formation, determination of the areas for innovation activity improvement, which will increase the IA effectiveness, is not less

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important. They include as follows: development of technological potential; improvement of investment activity; directions for goods promotion to the market; coordination of personnel work; reduction of risks; improvement of financial situation, resource availability; state regulation of IA and support for innovations adoption; determination of more profitable areas for activity; R&D and application of tax benefits; professional development of personnel, social security; development of the innovation market; regulation of prices for new products. If the results obtained correspond to the results planned, the industrial enterprise will successfully operate within a long period of time and apply a specified EMIA based on its adjustment.

CONCLUSIONS

Thus, EMIA application at industrial enterprises will be effective on condition of state support provision, involvement of investment capital in innovative technologies development, increase in the pace of scientific and technological development, establishment of preferential crediting system, reduction of tax pressure, implementation of innovations at the regional and enterprise level, development of the country's innovation potential and cooperation with foreign companies. The interaction of all EMIA elements is a prerequisite for its effectiveness and efficiency, a guarantee of innovation performance improvement and enhancement of industrial enterprise's activities.

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Writing – review & editing: Oleksander Cherep.

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University science

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UNIVERSITY SCIENCE

THE IMPACT OF URBANIZATION AND LIFESTYLE ON THE HEALTH STATUS OF CHILDREN IN THE KYIV REGION

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ABSTRACT

This study analyzes the impact of nutrition on the health status of children living in various regions of Ukraine with differing environmental conditions. Based on official statistical data from the Department of Health of the Kyiv Regional State Administration and the Health Department of the Darnytsia District State Administration in Kyiv, a comparative analysis of child morbidity was conducted in the urban-type settlement of Ivankiv, the village of P. Borshchahivka, and the Darnytsia district of Kyiv during the summer-autumn and winter-spring periods.

The aim of the study was to conduct a comparative analysis of the health status and morbidity dynamics of school-age and preschool children living in regions of the Kyiv area with different levels of urbanization and environmental load, as well as to determine the role of dietary factors and lifestyle in the formation of identified pathologies.

The research utilized a comprehensive approach, including medical surveys and statistical analysis of official data. Indicators of general and primary morbidity were evaluated across three representative groups: children from the radio-ecological control zone (Ivankiv), the suburban zone (P. Borshchahivka), and the metropolis (Darnytsia district, Kyiv).

Results revealed an increase in general morbidity across all groups, particularly regarding pathologies in the winter-spring period related to lifestyle (anemia, thyroid diseases, obesity, and digestive disorders) and nutritional quality. The highest growth rates of morbidity were recorded in the urbanized zone—the Darnytsia district of Kyiv. The results underscore the urgent need to develop and implement targeted programs for nutritional optimization and the prevention of non-communicable diseases among the pediatric population.

Keywords

Child morbidity, lifestyle, urbanization, rural areas, environmental factors, anemia, obesity, digestive system pathologies, Kyiv region, health ecology, disease prevention.

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INTRODUCTION

Child health is one of the most critical indicators of a society's well-being. In Ukraine, a worrying trend toward increasing chronic diseases among children has been observed over recent decades. This involves not only allergic and oncological pathologies but also diseases of the cardiovascular and gastroenterological systems. This situation is largely driven by global and local factors, including the consequences of the Chernobyl disaster and general environmental degradation.

In addition to environmental factors, lifestyle—especially the quality of nutrition—has a massive impact on child health. An unbalanced diet with a deficiency of essential nutrients in early childhood can lay the foundation for serious chronic diseases in the future, including obesity, diabetes, cardiovascular diseases, and cancer (Titenko, 2007; Heuvel et al., 2021; Vliet et al., 2020).

Modern urbanization has brought new challenges that exacerbate these risks: fast food accessibility, a sedentary lifestyle (hypodynamia), excessive academic loads, and a preoccupation with computer games (Black, 2013; Vliet et al., 2020).These problems are particularly acute in modern Ukraine, where significant contrasts exist between large cities and rural areas. Understanding how these differences affect child health is crucial for developing effective preventive measures.

The aim of our study was to examine the influence of environmental conditions and lifestyle on the morbidity rates of preschool children in urban (Kyiv) and rural settings, using the Kyiv region—which contains territories with varying levels of environmental load—as a case study.

LITERATURE REVIEW

The health status of the pediatric population under current transformations of the environment and social standards occupies a central place in biomedical research. The modern scientific paradigm views a child's health as a complex outcome of the interaction between genetic predisposition, environmental load, and lifestyle (Veenendaal et al., 2022; Zaporozhan et al., 2004).

Global urbanization processes have fundamentally changed the human habitat. According to current reviews, life in megacities is accompanied not only by high industrial pollution but also by the formation of a specific "urban" lifestyle that negatively affects the child's body (Veenendaal et al., 2022; Vliet et al., 2020). Experts note that high levels of air pollution and limited green zones in areas like the Darnytsia district correlate with increased respiratory and immune system morbidity. Conversely, rural areas often face the consequences of radiation contamination (particularly in the Ivankiv district), creating a specific background for the development of pathologies (Titenko, 2007).

Nutrition is a fundamental factor determining physical development and the functional state of all body systems. Lukushkina et al. (2010) emphasize that a deficiency of essential micronutrients in the diet serves as the basis for the development of iron-deficiency anemia and endocrine disorders. The issue of iodine deficiency remains particularly critical in Ukraine, leading to thyroid disorders and decreased cognitive functions in children (Assessment of iodine deficiency diseases..., 2008; Titenko, 2007).

Modern medicine classifies childhood obesity as a 21st-century pandemic. Recent scientific works highlight that urban environments foster a "toxic" food environment:

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high availability of fast food and products high in trans fats and sugar (Kmietowicz, 2018; Poti et al., 2014). Black et al. (2013) point to the "double burden of malnutrition," where overweight may coexist with micronutrient deficiencies. Physical inactivity caused by excessive gadget use and academic loads further reinforces these negative trends (Heuvel et al., 2021).

Studies on morbidity dynamics across different seasons indicate the seasonal vulnerability of the child's body. The winter-spring period is traditionally characterized by the depletion of the body's vitamin stores (Rebrov & Gromova, 2008).

MATERIALS AND METHODS

To achieve the set objective, methods of medical surveying and statistical analysis were employed. The analysis of child morbidity was based on official statistical data provided by the Department of Health of the Kyiv Regional State Administration and the Health Department of the Darnytsia District State Administration in Kyiv.

The study covered the summer-autumn and winter-spring periods of the year and was conducted among the following groups:

Children residing permanently in the Ivankiv settlement (territory affected by the Chernobyl accident);

Children residing in the village of P. Borshchahivka (close to industrial zones);

Children residing in the Darnytsia district of Kyiv (an urbanized territory with high levels of air pollution).

RESULTS AND DISCUSSION

General Morbidity and Its Dynamics

Analysis of statistical data revealed that the level of general morbidity is increasing across all examined groups; however, the growth rates differ significantly. The highest dynamic indicators were found in children living in the Darnytskyi district of Kyiv, where a 42% increase was recorded in the winter-spring period compared to the summer-autumn period. In the village of Petropavlivska Borshchahivka, the increase was less pronounced but still amounted to 3.2% during the winter-spring period. In contrast to urbanized areas, only a slight increase in general morbidity (1.4%) was observed in the urban-type settlement (smt) of Ivankiv.

Nutrition-Related Pathologies

Diseases of the blood and blood-forming organs. Particular attention is drawn to the incidence of blood diseases, which nearly doubled among children in the Darnytskyi district of Kyiv during the winter-spring period compared to summer-autumn. This pathology is 100% driven by an increase in anemias, primarily of a iron-deficiency nature. These anemias are a direct consequence of an unsatisfactory diet characterized by a deficit of products containing heme iron (meat, fish, eggs) and other essential nutrients.

Diseases of the endocrine system and metabolism. This group of diseases is of particular concern, as their number among children in the Darnytskyi district grew nearly fourfold during the observation period. The causes of these conditions include:

- Thyroid pathologies (goiter, hypothyroidism): caused by insufficient iodine intake;
- Obesity: its prevalence in the Darnytskyi district increased 3.5 times during the winter-spring period. Meanwhile, in rural areas (smt Ivankiv and P. Borshchahivka), obesity rates did not undergo significant changes, indicating a close link between obesity and the living conditions of a metropolis.

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Causes of rising obesity rates. Obesity is a multifactorial pathology involving not only the alimentary factor (excessive calories, chaotic eating patterns, frequent fast food consumption) but also physical inactivity (hypodynamia). The modern lifestyle of children in large cities is characterized by excessive academic workloads, total computerization, and a preoccupation with video games and television, leading to a sedentary lifestyle. Furthermore, the uncontrolled consumption of sweets as rewards and high-calorie foods rich in trans fats in fast-food establishments significantly exacerbates the risks.

Alimentary-Dependent Pathology

Diseases of the digestive system. Statistics on digestive diseases also confirm the influence of the nutritional factor. In smt Ivankiv, the level rose by 4% in the winter-spring period, while in the Darnytskyi district of Kyiv, it rose by 70%. This indicates more irrational nutrition in urban environments. The most common diagnoses include gastritis, duodenitis, cholecystitis, cholangitis, and pancreatic diseases. According to the WHO, nutrition plays a leading role in the development of these pathologies.

Analysis of the Health Status of Preschool Children

To better understand the problem, an additional analysis of morbidity among preschool children from the Ivankiv district (Kyiv region) and the city of Kyiv was conducted for the summer-autumn and winter-spring periods (Table 1).

Table 1. Comparative characteristics of morbidity in preschool children of Ivankiv district and Kyiv (absolute figures)

Source: Ministry of Health of Ukraine, 2022.

Disease Name (ICD-10)	Region	Summer-Autumn (Total / First-time)	Winter-Spring (Total / First-time)
All diseases (A00-T98)	I	4589 / 3616	4732 / 3710
	II	485085 / 428862	498182 / 439120
Blood diseases & anemia (D50-D64)	I	48 / 16	58 / 20
	II	11427 / 4305	22350 / 8420
Endocrine diseases (E00-E90)	I	90 / 11	94 / 12
	II	5553 / 2414	22100 / 9580
Obesity (E66)	I	5 / 1	8 / 2
	II	404 / 153	1414 / 535
Digestive diseases (K00-K93)	I	149 / 53	342 / 121
	II	22488 / 11775	38230 / 19850
Respiratory diseases (J00-J99)	I	3435 / 2961	3580 / 3050

Note: I — Ivankiv district; II — Kyiv city.

Key Trends Identified in the Data:

- **General Morbidity:** Increased by 3.1% in the Ivankiv district and 2.7% in Kyiv.
- **Cancer Incidence:** Data regarding oncological diseases are particularly alarming. In the Ivankiv district, the number of cases in the winter-spring period increased 2.5 times, while in Kyiv, the increase was only 5.2%. Although nutrition is not the primary factor in the etiology of cancer, recent scientific publications emphasize its importance in

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the onset, progression, and prevention of these diseases.

- **Blood Diseases:** In the Ivankiv district, the incidence rose by 20.8%, which is 100% attributable to the growth of iron-deficiency anemias.
- **Obesity:** The incidence of obesity in the Ivankiv district increased 1.6 times. This confirms that the problem is relevant not only for cities but also for rural areas. Excessive protein consumption at an early age may also lead to the development of obesity, diabetes, and arterial hypertension in the future.
- **Other Pathologies:** Analysis showed a significant growth in digestive diseases in the Ivankiv district — increasing 2.3 times. This includes gastritis, duodenitis, cholecystitis, and pancreatic diseases, signaling nutritional issues in rural regions as well as urban ones.

CONCLUSIONS

A steady increase in the overall incidence rate has been identified across all studied groups. The most pronounced dynamics were recorded in the urbanized zone — the Darnytskyi district of Kyiv, particularly regarding pathologies closely linked to diet and lifestyle (anemia, thyroid diseases, obesity, and digestive system disorders). Specifically:

- **Overall incidence** among school-age and preschool children living in both urban and rural environments shows a steady upward trend;
- **The growth rates of nutrition-related pathologies** are significantly higher in large urban settings (Darnytskyi district, Kyiv). This may be driven not only by poor diet but also by concomitant factors such as physical inactivity (hypodynamia), stress, and adverse environmental conditions;
- **There is a need to develop and implement** comprehensive programs promoting an active lifestyle, especially in conditions of intensive urbanization, and to introduce targeted programs for the prevention of non-communicable diseases among the pediatric population.

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University science

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UNIVERSITY SCIENCE

FORMATION AND DEVELOPMENT OF INNOVATION ACTIVITY AREAS AT THE INDUSTRIAL ENTERPRISE

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ABSTRACT

It is established that resolving nearly all key problems of the agro-industrial complex functioning as well as searching for opportunities to raise the population's standard of living are aimed at providing the nation with food. It is proved that food security is of special significance in the life support of society, since availability of food is fundamental for human life. The characteristic features of food security in the current conditions are revealed. The principles for the national food security system are determined. It is substantiated that the principles of self-sufficiency, independence, accessibility and quality are paramount in the process of shaping the state policy of food security. The figures show that the population of the world is growing rapidly, and consequently, the amount of food consumed is only increasing. Since Ukraine is a country with a developed agricultural sector, one of the leaders in this industry's development globally, it should be among the countries responsible for solving foodstuff issues. It is noted that throughout the history of statehood, the problem of stable food supply to the population has been among the most important ones as it affects national security. It is shown that there are different ways of combating food security problems by states. The article examines the regulatory and legal support for sustainable economic development, given the provision of food security based on self-sufficiency. The authors put forward the suggestions with regard to formation of the main directions for achieving food security on the basis of the principles of sustainable economic development.

Keywords

Food security, economic security, national security, food security index, agro-industrial complex, food industry, security system.

Classification JEL: Q 18, H 56

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STATEMENT OF THE PROBLEM

People are malnourished everywhere, the ratio of hungry and hungry in different countries is different. Every night one in seven people on the planet goes to bed hungry. There is concern that this is not the limit: demand for food is expected to increase by 70% by 2050. All the horror of the situation is that 80% of the world's hungry are directly involved in food production.

Along with other problems of economic development in the current context, the problem of food security is becoming more acute and of increasing importance in the structure of economic security. It is in providing the country with food intertwined and concentrated in a complex knot virtually all modern numerous problems and pain points of functioning of the agro-industrial complex and its basis - agriculture.

As noted above, providing the population with sufficient food is one of humanity's most important problems. Today, about 40 million people die of starvation and the effects of hunger, including 13 million children every year. More than 40% of the population suffer from micronutrient deficiencies, which can be called "hidden hunger". Therefore, the problem of food security and food security for countries is as urgent as ever.

The urgent issue of food security is also to ensure that the agricultural sector is in a good condition. Unconditional is the fact that the level of food security directly depends on the level of food security of Ukraine. Nowadays, agro-industrial complex provides 95% of food resources, more than 2/3 of the consumer goods fund is being formed at its expense; the value of fixed assets is 30% of their total value in the national economy. Almost all agricultural products are designed for the consumer, manufactured for the market. At the same time, it is an extremely voluminous market for other areas of material production.

ANALYSIS OF RECENT STUDIES AND PUBLICATIONS

Well-known scientists have been involved in the study of food security, including A. Marshall (1892), D. Ricardo (2025), A. Smith (1776), and others. Issues of state regulation of food security were given attention by Ukrainian and foreign scientists. Significant contribution to the theory and practice of ensuring food security of Ukraine has been made by such specialists as V.G. Andriychuk (2002), . Borschevsky P.G. (2000) , V. G. Geets (1996), O.I. Goychuk (2019), S.O.Grigoriev (2016) , T.G.Dudar (2009), Dudar (2009), V.K. Zbarsky (2009), M.A. Misevich (2009), S. M. Kvasha (2016), O. S. Reznikova (2010), P. T. Sabluk (2011) and others.

Kazakh scientists pay a lot of attention to the main threats to food security of the regions and prospects for their further development in the Republic of Kazakhstan. Kazakh scientists, in particular Bekenov S.S. (2003), Eszhanova Zh. Zh. (2004), Zhanbekova Z.H. (2008) exploring the problem of maintaining an acceptable level of food security, rightly point out that at the center of the problem of food security is a man - a citizen of the country and the consumer.

OBJECTIVES OF THE ARTICLE

The purpose of the article is to analyze the current stage of food security in Ukraine and the countries of the world and to develop directions for achieving food security in accordance with European food quality standards.

RESEARCH METHODS

In the process of the study, the method of absolute and comparative advantages is used, which allows to characterize the features and problems of stable food security of the population, on which national security depends. The use of economic methods of optimization

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and determination of equilibrium allows to reveal the feasibility of attracting investments in agriculture in our country, which is directly related to global problems of ensuring food security. The use of scientific abstraction made it possible to form the problems of global hunger and take into account the position of the World Bank on the implementation of the program of investment in the agricultural sector of Ukraine. The use of general economic and specific scientific methods made it possible to develop vectors for achieving food security in accordance with European food quality standards.

THE MAIN MATERIAL OF THE RESEARCH

The legislation of Ukraine gives the following interpretation to the concept of "food security": Food security is the protection of the vital interests of man, which is expressed in guaranteeing the state of unimpeded economic access to food for the purpose of maintaining its normal life activity.

Food security is characterized by the following features (Bekenov, 2003):

1) ensuring that the population has the necessary food at a scientifically sound medical level;
2) creation of the necessary food reserves in the state, in case of unforeseen circumstances (natural disasters, crop failures, floods), in the amount of six-monthly, and even annual stocks;
3) provide opportunities to enter the global market with competitive products to address global and regional food and energy issues, as well as financial problems of economic agents.

Throughout the history of statehood, the problem of stable food security for the population has been one of the most important, as national security depends on it. So, different countries have come up with ways to combat malnutrition.

For example, Brazilian theory: starving is possible if you support local farmers. By investing in the food industry (small business) and agriculture, Brazil has reduced the number of people affected by poverty by 20 million from 2003 to 2009. The state purchased food from small farms, providing socio-economic development in rural areas.

Example of France: In May 2018, the French Parliament approved a law banning large food supermarkets from throwing away unsold but edible food. Now they are obliged to donate such goods to charities that give it to the poor. It is worth paying tribute to the French - an effective way out of a critical situation.

The national food security system is based on the principles of self-reliance, independence, accessibility and quality. These, in the first place, should be taken into account in the formulation of state food security policy. The following must also be ensured: the effective development of the food industry, foreign economic activity in the food industry, the generation of household income, the guarantee of balanced and quality consumption.

The importance and necessity of guaranteeing Ukraine's food security requires maintaining an adequate level of food security. This, in turn, involves using state support for domestic food companies and taking measures to control imports to support domestic producers. The security of food security is both sufficient food self-sufficiency and the availability of funds for their import in the necessary volumes in the conditions of minimal potential vulnerability of food security of the population in case of complications with food imports (lack of currency, rising prices, embargo etc) (Eszhanova, 2004).

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The main components of the state policy formation in the field of food security are shown in Figure 1.

In order to achieve food security at the level of the self-sufficient state, Ukraine must be based on its own production. Food self-sufficiency means that most of the food needs are met through domestic production. Therefore, the food-processing industry is the center of food security. For this purpose it is necessary to establish control over such subsystems as planning, marketing and distribution; food reserves and consumption; personnel, information, advisory, financial, scientific and logistical support, etc (Zhanbekova, 2008; Lyko, Babienko, Buzovsky, Ishchenko, 2005).

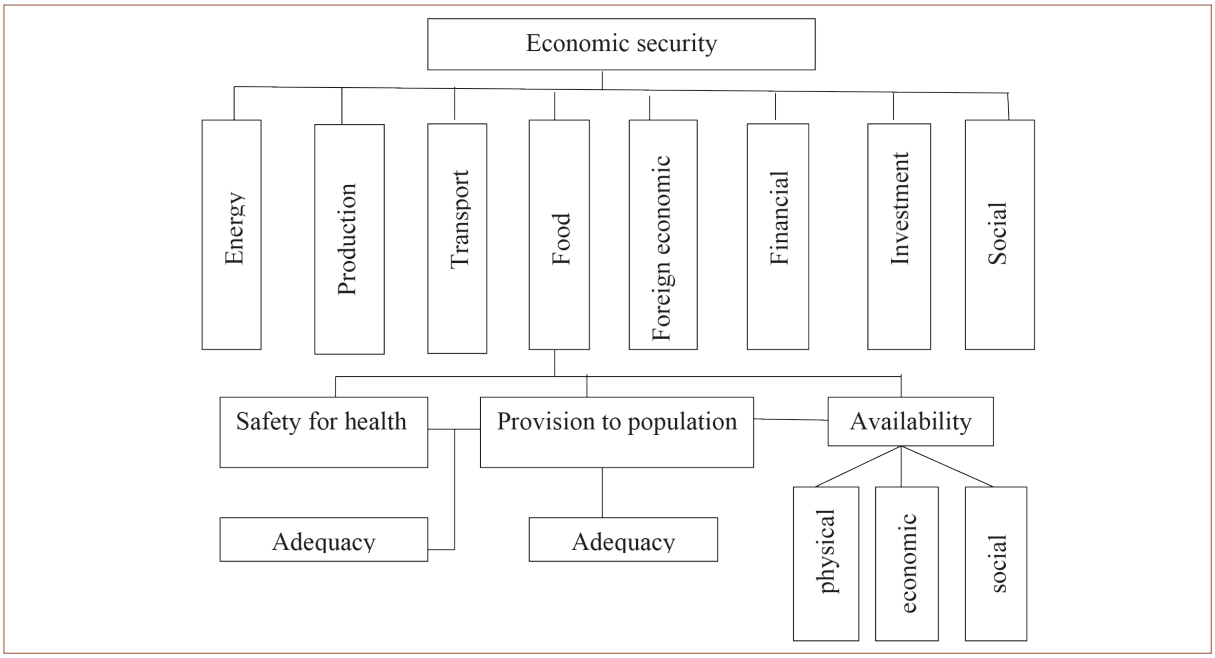

Fig. 1. The main components of the state policy formation in the field of food security

Source: Zhanbekova, 2008; Lyko, Babienko, Buzovsky, Ishchenko, 2005

On October 17, 2014, Yatsenyuk published an article with a rather interesting title on the site "Economic Truth": "Food security of the world depends on Ukraine". Some of the former Prime Minister's quotes and opinions are as follows.

"The world's food security depends on Ukraine - we are one of the key players. The government's plans to seize leadership in the food market together with other countries in the world (USA, Canada, several EU countries),"- Yatsenyuk stressed.

Food security for entire regions of the world depends on Ukraine. Ukraine is a bronze medalist in grain exports.

As noted above, the demand for food will increase by 70% by 2050. This means that around 1 billion tonnes of cereals will need to be produced in excess of existing volume. And this challenge is not addressed to anyone, but to Ukraine, because last year our country was ranked third in the world in their export. And given that the EU is a union of 28 individual countries, and the United States surpasses us by nearly 16 times, Ukraine is the most productive country in this respect (fig. 2).

Despite the general crisis in the country, things are going well enough in the agricultural sector: the industry is growing its share in the economy even in this difficult time. Some

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regions of the world, especially the Middle East, are directly dependent on supplies from Ukraine. This makes investing in our country's agriculture a global food security issue. Therefore, the World Bank is working on a program to invest in the agricultural sector of Ukraine. Paradoxically, Ukraine plays a key role in solving the problem of global hunger.

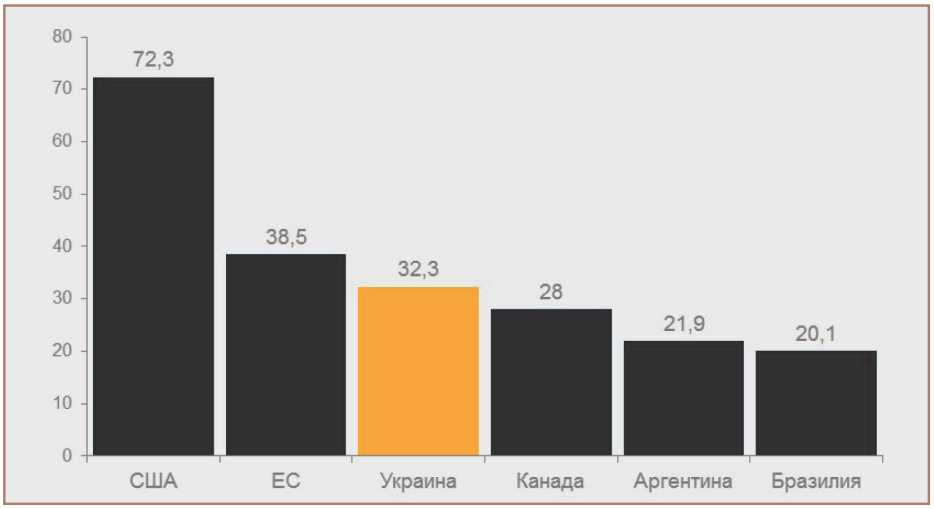

Fig. 2. Grain export leaders in the world.

Source: Agricultural Market Information System

And we can do more. There is considerable potential for increasing grain production in Ukraine. The 2018 harvest figures suggest that our exports will increase.

A reprint from the Ex - Minister of Agrarian Policy Oleksiy Pavlenko: "Ukraine is self-sufficient in all types of food products. Ukraine produces several times more than it consumes domestically, enabling it to occupy a leading position in the world of agricultural exports without compromising its food security".

The share of spending on food in Ukraine is 4.5 times higher than in the EU-28, where it averages 12.2%: from 8.2% in the UK to 27.8% in Romania.

However, according to the official report of the 2017 report, Ukraine still dropped to 16 positions in the Global Food Security Index – from 47th to 63rd rankings. Poverty has become a major feature of domestic life.

The structure of consumer spending in some post-Soviet countries (Kazakhstan) is more comparable to Ukraine.

In all countries, the highest share of household consumption expenditures is on food expenditures.

Households in the post-Soviet space, in contrast to the EU, are characterized by a low share of spending on culture and recreation, restaurants and hotels.

It should be noted that the share of expenditures on housing and communal services and energy resources in Ukraine is the highest among the post-Soviet countries. The smallest part of consumer spending on this item is directed by Belarusians (7.1%), and the highest – Kazakhs (12.7%).

The share of consumer spending on transport differs significantly, amounting to only 3.9% in Ukraine and between 8% and 14% in other post-Soviet countries.

It should be noted that President Volodymyr Zelensky endorsed Ukraine's 2030 sustainable development goals. The relevant decree No. 722/2019 was signed by the President on 30 September (Website of the State Statistics Committee of Ukraine 2019; Khorunzhiy, 2003).

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The document, in particular, provides for ensuring that Ukraine's sustainable development goals are met by 2030. Among them, the first places were the following goals:

1) overcoming poverty;
2) overcoming hunger, achieving food security, improving nutrition and promoting sustainable agriculture;
3) ensuring a healthy lifestyle and promoting well-being for all at any age.

We hope that the goals of Ukraine's sustainable development have not only been approved but will be realized. Addressing the food security of countries, including Ukraine, is possible under the proper financial regulation, through lending, innovations, regulation of import-export activities in the agricultural sector and investment in agriculture, etc.

CONCLUSIONS

So, given the research and the Ukrainian realities, food security is a level of food security for the population that guarantees socio-political stability in society, survival and development of the nation, individuals, families, sustainable economic development of the state.

There are two main areas of food security in Ukraine. First, it is necessary to ensure the supply of food in such quantities that could provide a healthy and complete nutrition for the population. Secondly, exports must be emphasized. Ukraine's agrarian success awaits the whole world. Our mission is to increase production volumes and bring our products in line with European quality standards that can serve as a benchmark for us during this historic period.

If Ukraine can be of some use to the world community, then it is in food security.

The food problem belongs to the category of global. To solve the food problem, the efforts of a single state are not enough, and a well-established cooperation of all countries, regardless of their social order, is required.

After all, effectively addressing food security is the key to future generations prosperity.

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University science

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UNIVERSITY SCIENCE

FORMATION AND DEVELOPMENT OF INNOVATION ACTIVITY AREAS AT THE INDUSTRIAL ENTERPRISE

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ABSTRACT

The current state of digitalization of the countries of the world has been investigated and the expediency of increasing the level of digital literacy of society has been substantiated. It has been established that a noticeable movement towards increasing digital competencies, which is associated with the introduction of information and communication technologies, was made both during the pandemic and in Ukraine - with the beginning of the full-scale Russian invasion. It has been proved that the key step in building open government is the use of e-democracy tools. Electronic democracy is singled out as a type of social relations in which citizens and organizations participate in the formation of the state and public administration, as well as local self-government through the active use of information and communication technologies in democratic processes. It has been proven that there is a need for cooperation with the private sector and the need to make many efforts to bridge the digital divide in cities and rural areas by extending e-government services to rural areas. The digitalization of customs is also important, which allows expanding the country's economic system and controlling the state of queues at checkpoints, automatically calculating the cost of customs duties, excise duties and other payments, as well as simplifying and speeding up the mechanism for submitting documents for customs control through the electronic cabinet. Proposals have been made to increase the efficiency of the use of information and communication technologies in the digital society.

Keywords

Digitalization, information and communication technologies, state formation and public administration, digital government services, information society.

Classification JEL: A 10, L 86

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ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In the context of the Russian-Ukrainian war and the post-COVID period, the issues of ensuring digital literacy of the population in order to ensure a high level of competitiveness are relevant. Problematic issues of digitalization of the economy were studied by scientists: Andriyiv N. (2022), Brodny J., Tutak M. (2022), Brynjolfsson E.& McAfee E. (2016), Cherep A. V. (2018, 2022, 2024), Cherep O. H. (2018, 2022, 2024) & Ohrenych Y. O. (2022), Shvets Y. O. (2018), Ohrenych Yu., Helman V., Gorbunova A. (2024), Ovander N.L. (2018), Paul-Jasper Dittrich (2020), Pavliuk A., Liapin D. (2012), Qiong Xu, Xin Li, Yu Dong & Fei Guo (2023), Rahmouni M. (2013), Ramachandran R. (2019), Repeta Yu. V. (2022).

It is digitalization that allows you to improve the quality of life of the population, both Ukrainians and the population in other countries of the world. Therefore, the topic is relevant and timely today and in the future.

The aim of the article is to develop e-democracy tools to increase the efficiency of the use of information and communication technologies in the digital society. It is proposed to use digital technologies in order to form an effective dialogue between the public and the state.

RESEARCH METHODS

In the process of scientific research, the method of grouping was used in order to analyze the development of digital public services and the introduction of special digital technologies by regions of Ukraine. Also, in the process of studying the tools of e-democracy, general economic and specific scientific methods were used, which made it possible to study the impact of digital technologies on the efficiency of decision-making and effectively manage financial flows, reform education to improve competence and creation of a stable economic system with the possibility of strategic planning. The proposed measures using synthesis methods make it possible to make proposals for reforming the processes of digitalization of social programs that provide support to the population.

RESULTS

Ukraine in 2024 ranked 5th in the world in terms of the development of digital government services according to the Online Services Index rating, which is part of the international study of the UN e-Government Development Index (table 1) (Ukraine is among the top 5 countries in terms of e-government services development, 2022).

Table 1. Online Services Index rating, which is part of the international study of the UN e-Government Development Index

Source: Ukraine is among the top 5 countries in terms of e-government services development, 2022:

Place in the ranking	Country
1	Republic of Korea
2	Denmark
3	Estonia
4	Saudi Arabia
5	UKRAINE
6	Singapore
7	Great Britain and Northern Ireland

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Table 1 (continued)

8	New Zealand
9	Japan
10	Kazakhstan

During the development of the information society, information becomes not only the main means of increasing the competitiveness of the enterprise, but also the main source of cooperation and collaboration among enterprises. Moreover, the exchange of knowledge is possible not only among enterprises, but also directly from the enterprise to customers. Means of knowledge exchange are used by 5786 enterprises for 2024, with a tendency to increase in the following periods.

In order to spread mobile and Internet communication, to control the quality and speed of services provided, the Ministry of Digital Transformation of Ukraine created the BroadBand project (Project «Concept of development of digital competencies in the society of Ukraine» Cabinet of Ministers of Ukraine, 2020). On the project site, each user can provide location data and the program automatically measures the speed of the Internet. The site should check the availability of services throughout the country, their speed and, as a result, the collected data should become a prototype of the Internet map of Ukraine.

It is also important to remember that ISPs are private businesses that have a vested interest in making a profit. Creating conditions for controlled competition is the key to continuous improvement of their services by providers, to competition in the price level, which will reduce existing prices and to the constant expansion of the network, which will help the state digitalization to be comprehensive.

To achieve the digitalization of all existing regions in Ukraine, special programs are also being implemented, one of which is the EGAP program.

The E-Governance for Accountability and Participation Program (EGAP program) (Project «Digital Agenda of Ukraine - 2020», 2020) is realized during 2015–2023 by the Eastern Europe Foundation and the Innovabridge Foundation in partnership with the Ministry of Digital Transformation of Ukraine. The program is implemented with the support of Switzerland, provided through The Swiss Agency for Development and Cooperation (SDC). The target regions are Vinnytsia, Volyn, Dnipropetrovsk, Luhansk and Odessa regions (E-Governance for Accountability and Participation (EGAP), with the support of Switzerland, 2022).

The work continues on two key components: the development of e-services and e-democracy both at the national level and in the regions of Ukraine (or at the community level).

Such a transformation not only contributes to the development of individual regions, but also accelerates the digitalization of the country as a whole and strengthens the decentralization processes taking place in recent years.

An interesting project of the Ministry of Digital Transformation is the introduction of «Smart City». This initiative was first taken by the capital, creating Kyiv Smart City in 2015, in order to technologize the capital of Ukraine - the city of Kyiv through the introduction of «Kyiv Card» projects: online recording and support of city projects with the establishment of an open data portal, online registration to doctor, electronic queue to

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kindergartens, integrated video surveillance system, electronic petition system, etc. That is, all basic services of communal, private, city, state enterprises must be digitized and interconnected.

However, as of 2020, even Kyiv has reached only the first stage of «Smart City» 1.0, which means the lack of a common strategy, and that automation has affected individual, unrelated components.

Data openness is the foundation of both the information and digital societies. In order to promote the transparency of authorities, each government agency has a website or social network page that reflects the main news, general reports, project and planning indicators and it maintains public relations.

An important step in the development of open authority is the use of e-democracy tools. Electronic democracy is a form of public relations in which citizens and organizations are involved in state formation and public administration, as well as in local self-government through the widespread use of information and communication technologies in democratic processes, which allows to:

- strengthen the participation, initiative and involvement of citizens at the national, regional and local levels in public life;
- improve the transparency of the decision-making process, as well as the accountability of democratic institutions;
- improve the response of the subjects of power to the appeals of citizens;
- facilitate public discussions and draw citizens' attention to the decision-making process.

The most common tools of e-democracy used today in Ukraine at both the national and local levels are e-consultations, e-petitions, e-appeals, participation budgets (public budgets).

The resources have also been created for the publication of datasets in the form of open data, including the use of electronic platforms such as Civil Society and Government, Smart City or the Single System of Local Petitions, which combine several electronic tools for participation.

At the present stage of development the state online platforms have become a special source of information, they provide simplification of some services, promote the dissemination of information in society, and ensure digitalization of the population of Ukraine.

The «Action» platform is the main portal of today; it is created and managed by the Ministry of Digital Transformation (Project «Digital Agenda of Ukraine - 2020», 2020). «Action» is a multifunctional portal that is a direct link between the state and citizens. In general, the platform can be divided into the following main activities:

- Identification of the population with the help of electronic documents in the mobile application «Action»;
- Online service for providing public services;
- "Action. Digital Education «as an educational portal available to the public for the purpose of teaching digital literacy;
- Small and Medium Business Assistance Portal "Action. Business».

Identification reform consists of the gradual reformatting into electronic form of old identification documents, the change in the outdated form of record keeping, the introduction of new standards and processes, etc. «Digitalization» of the sphere of citizen identification and introduction of both the state system based on ID-cards and alternative BankID and MobileID provide an opportunity to change the «paper» system of public administration, i.e. to make a «digital» leap in the development

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of e-government, e-democracy. In addition, it is a powerful impetus to the development of e-commerce and «digital» economy in general.

Identification using BankID and MobileID for public services, especially in the implementation of deeds, etc., requires the creation of a state infrastructure for identification and verification of users of these tools. In this perspective, the issue of certification of international data protection standards (ECC, RSA) in Ukraine is also important. The main drivers of BankID and MobileID are respectively banking institutions headed by the National Bank of Ukraine and mobile operators. In this direction the key actions of state institutions should be the issues of standardization of electronic identification means, including in the field of data security.

In the future, access to information of all available portals will be provided from this mobile application. The portal allows you to receive services remotely, with the provision of official documents in electronic form. In this way, administrative services become more accessible to the population and business, and the connection between the state and the public becomes a question-and-answer forum.

The Single State Portal of Administrative Services managed by the Ministry of Economic Development and Trade of Ukraine is also quite easy to use (The Single State Portal of Administrative Services, 2022). This portal offers a wide range of services to citizens and businesses, but does not provide them with online access, but only ensures basic information about the service and where to receive it. Thus, this platform is more informative, but its basic information can be as additional material for the platform "Action".

The tax policy of the state has always been burdened with accounting papers, constant recalculation of cash flows and grouping of tax payments. The introduction of electronic registers of taxpayers by the State Tax Service allowed moving to the electronic circulation of documents with automated calculation of tax payments. The function to search for companies in the register of taxpayers under the USREOU code is also convenient to identify arrears of tax payments from businesses that the company cooperates with (State Tax Service of Ukraine, official portal, 2020).

Digitalization of customs also occupies a prominent place for the country's economic system. The web portal «Single Window» was created to facilitate international trade; it is a reference and functional site of the State Customs Service of Ukraine. The site allows you to monitor the status of queues at checkpoints, calculates automatically the cost of customs duties, excise duties and other payments, as well as simplifies and speeds up the mechanism of submission of documents at customs control due to the electronic cabinet.

If the tax policy is directly related to business entities and the population, then the budget system concerns the administrative functions of the state. The platform «Open Budget» was developed to monitor the state budget of Ukraine, its implementation, analysis, as well as statistical and analytical data of local budgets. All cash flows, execution of approved budget items, the process of execution of local budgets are reflected by this platform in free access for all network users. Thus, the budget policy of the state becomes transparent and open (Web-portal State Budget for citizens «Open Budget», 2022).

In general, all official state platforms with the gov.ua domain have informative or informative-functional content to simplify the provision of administrative services. Digitization of such sources requires that citizens have some knowledge about these services, the use

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of Internet resources or communication services and the use of the interface, as different age groups have different attitudes to such innovations.

For this the state must digitize additionally socio-economic spheres, and first of all, must create accessible educational programs for the population on the digitalization of society.

Thus, the «Action» platform also has educational resources - short videos that help users to master confidently the programs and to understand the legal and accounting basis of the services they use. The Digital Education program has information materials explaining clearly the innovative technologies of the modern world for both children and adults. Also under the conditions of quarantine, the digitalization of education has accelerated significantly, as education took place remotely in most of the country.

The Law of Ukraine «On Education» defines information and communication competence as one of the key competencies necessary for every modern person for successful life. In the Digital Competency Framework for citizens of Ukraine, the levels of mastery of competencies (basic, intermediate and high) are divided conditionally into sets of areas of competence:

1) basics of computer literacy;
2) information literacy, ability to work with data;
3) creation of digital content;
4) communication and interaction in the digital society;
5) security in the digital environment;
6) solving problems in the digital environment and lifelong learning (Project «Digital Agenda of Ukraine - 2020», 2020).

As a result of the reform, each person must master certain skills, form the worldview of the new digital society. At the same time, government activities should become transparent to society and, with the help of digital technologies, increase the efficiency of decision-making, and manage effectively financial flows, responding to all changes in society. For business, education reform will help to increase the competence of producers, facilitate access to export trade and create a more stable economic system with the possibility of strategic planning.

In accordance with the European Union program «European Health Strategy 2020» in Ukraine it is necessary to develop and ensure the implementation of the National Program «Health - 2020: the Ukrainian dimension», which will improve approaches to methods of solving pressing problems in the field of health care. «Digital» medicine should provide interaction among patients, health professionals and institutions through «digital» technologies. The transition of medical document management to digital format is a key goal of «digital» medicine in Ukraine.

A necessary condition for achieving this goal is the creation of a national Electronic Health Record (EHR) system. EHR is a dynamic set of systematized electronic data on the state of health of an individual patient, which provides information exchange among participants in the process of production and consumption of medical services.

Social programs that provide support to the population are also being digitized gradually. The most modern projects are considered to be E-residence, E-baby, which were proposed by the Ministry of Digital Transformation and introduced in 2020.

E-residency creates a special status of a foreign citizen in Ukraine, which opens access to information and consulting services, simplifies the procedures for obtaining administrative services and concluding civil law agree-

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ments, as well as gives him the opportunity to establish and conduct business in Ukraine remotely. The project is created primarily for representatives of the creative industry - IT, marketing, advertising, and gaming.

E-baby - a complex service for parents of newborns. With one application you can get about 10 public services from different authorities at the same time. This simplifies the system of accounting for newborns and the time spent by parents on child registration.

CONCLUSIONS

Payment for goods and services in the digital society must be made entirely through electronic payment systems. In order to ensure a reliable system of electronic payments and interbank settlements, the National Bank of Ukraine has created a system of electronic payments - SEP. It handles more than 96% of interbank settlements, as well as real-time customer transfers. On average, SEP processes 1.5 million payments worth about UAH 173 billion a day. However, the potential of SEP is much greater - the margin of SEP capacity allows processing almost 10 times more documents per day than the current volume.

Digitalization creates an accessible and open society and the transformation of public services into digital forms an effective dialogue between the public and the state. In general, digitalization extends to absolutely all functions of the state and provides intensive development of all spheres.

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UNIVERSITY SCIENCE

THE ENERGY-INFORMATION SPECTRUM OF BIOLOGICAL SYSTEMS: INVESTIGATING THE FUNCTIONAL STATE OF THE HUMAN BODY VIA BIORESONANCE SCREENING

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ABSTRACT

The article is dedicated to the objectification of the functional state of the human body through the lens of the Energy-Informational Paradigm (EIP), which views biological systems as complex, hierarchically organized objects where Energy (E) and Information (I) are inextricably linked as manifestations of a single fundamental field. In contrast to the classical reductionist model, this approach posits that all biochemical and physical processes are a dynamic expression of the E ↔ I relationship.

The relevance of the work lies in the necessity of assessing the functional (energy) balance of systems at the subclinical level by studying the Energy-Informational Spectrum (EIS), which is in-accessible to traditional methods that register already formed structural or biochemical pathologies. The study examined the functional state of the body's systems using the method of Func-tional Bioresonance Diagnostics (FBRD) with the KRK BARS hardware-software complex on a sample of residents from the Bucha district of the Kyiv region (n=100).

The results of the screening demonstrate a relative balance in most systems, however, statisti-cally significant deviations from homeostasis were found in two key systems, indicating energy hyperactivity of the musculoskeletal system (56.3%) and the digestive system (54.0%). These indi-cators correlate with possible inflammatory or degenerative processes (arthritis, gastritis, colitis) and may be a sign of a systemic process or a consequence of chronic activation of the autonomic nervous system (51.4%) due to stress, etc.

The scientific novelty of the work lies in the practical application of the EIS concept for detecting systemic imbalance and hypothetical forecasting of possible pathological states. It is proven that bioresonance screening can serve as an objective tool for assessing systemic functional imbalance and monitoring the effectiveness of therapeutic interventions.

Keywords

Energy-Informational Spectrum, Energy-Informational Paradigm, energy, infor-mation, wave in-teraction, bioresonance screening, functional state of the organism, homeostasis, musculoskeletal system, digestive system.

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INTRODUCTION

In recent decades, a shift in the scientific paradigm has necessitated a reimagining of biological systems as complex energy-information orders. The classical reductionist model is gradually being supplemented by the EIP concept. This approach postulates that biological systems are complex, hierarchically organized objects (Prigogine & Stengers, 1986; Gotovskiy et al., 2010). According to the evolutionary principle, the increasing complexity of a biological system is accompanied by an expansion of its information spectrum (Mataus, 2025; Gariaev, 2020).

The relevance of this study lies in the need to objectify the functional state of the human body through the lens of its EIS. Unlike traditional methods, the registration of vibrational interactions allows for the assessment of systemic balance at the preclinical stage.

LITERATURE REVIEW

The current stage of development in biophysics and medicine is characterized by a transition from a purely mechanistic understanding of living systems to the energy-information paradigm (EIP). According to studies by Mataus (2025), the energy of the Universe is viewed as the fundamental basis of life, where biological objects act not merely as consumers of resources, but as complex resonators functioning across a wide spectrum of frequencies.

The issue of the hierarchical organization and orderliness of biosystems is closely linked to information theory (Prigogine & Stengers, 1986). The use of the Shannon-Wiener diversity index allows for the mathematical substantiation of the complexity of the body's internal organization: the higher the hierarchical level, the greater the volume of information it can integrate, while simultaneously reducing internal entropy to maintain homeostasis (Calculator-Ultra, n.d.; Mataus, 2025).

Analysis of scientific works in the field of functional diagnostics indicates a growing interest in methods based on the registration of weak electromagnetic fields. Researchers emphasize that biological systems possess a unique "frequency passport." Deviations from the physiological norm (homeostasis) primarily manifest as changes in the energy-information spectrum (EIS) even before the appearance of morphological changes detectable by traditional diagnostics (Oschman, 2015; Gariaev, 2020).

In works dedicated to bioresonance technologies and energy medicine (Gotovskiy et al., 2010), it is noted that:

- **System Sensitivity:** Higher levels of organization (CNS, ANS) respond to low-intensity information signals, allowing for the detection of stress and maladaptation at early stages.
- **Energy Balance:** A state of hyperactivity (values >50%) is associated with acute phases of inflammation or compensatory tension, whereas a deficit (<50%) is interpreted as a depletion of reserves or degenerative changes.

MATERIALS AND METHODS

For the screening assessment, the method of Functional Bioresonance Diagnostics (FBRD) was applied using the KRK BARS hardware-software complex. The methodology is based on the principles of registering the body's response to low-intensity electromagnetic signals (Gotovskiy et al., 2010). The sample size consisted of 100 individuals (residents of the Bucha district).

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THEORETICAL AND METHODOLOGICAL FOUNDATIONS

The concept of the **Energy-Information Spectrum (EIS)** postulates that energy (E) and information (I) are inextricably linked. The evolutionary principle suggests that the development of matter is accompanied by a decrease in the level of free energy as the degree of complexity increases (Bischof, 2005; Prigogine & Stengers, 1986). Each level of organization possesses a specific reactivity:

- **Higher levels:** Sensitivity to a broad informational spectrum.
- **Lower levels:** Reactivity is limited by an energy barrier.

FIELD OBSERVATIONS AND RESULTS

The examination results (Table 1) demonstrate the energy state of various systems. The highest levels of tension were recorded in the musculoskeletal system (56.3%) and the diges tive system (54.0%).

Table 1. Indicators of the Functional State of Body Systems Based on Energy-Information Screening (n=100)

Source: Mataus, N., 2025.

Biological System	Indicator, %	Interpretation of Energy State (EIS)	Prognosis of Possible Functional/ Pathological States
Musculoskeletal	56.3	**Pronounced hyperactivity:** Significant energy tension; acute or decompensated chronic inflammatory process.	Arthritis, arthrosis in the acute stage, spondyloarthropathies, pronounced fibromyalgia.
Digestive	54.0	**Moderate hyperactivity:** Energy tension, irritation of mucous membranes, functional overload.	Gastritis, duodenitis, Irritable Bowel Syndrome (IBS), biliary dyskinesia.
Circulatory	51.9	**Mild activation:** State of functional tension, strengthening of compensatory mechanisms.	Vascular hypertonus, predisposition to arterial hypertension, compensatory tachycardia.
Autonomic Nervous (ANS)	51.4	**Sympathicotonia:** Shift in balance toward activation (ergotropic phase), signs of chronic stress.	Neuroses, neurocirculatory dystonia, psychosomatic tension.
Muscular	50.6	**Physiological limit of norm:** Minimal functional tension against a background of stability.	Muscle hypertonus (primarily secondary, caused by the musculoskeletal system state).
Lymphatic	49.9	**State of homeostasis:** Optimal level of energy metabolism, stability of lymph drainage function.	Within physiological normal limits.
Central Nervous (CNS)	49.9	**State of homeostasis:** Balanced processes of excitation and inhibition, functional equilibrium.	Within physiological normal limits.
Respiratory	49.7	**Initial hypofunction:** Minimal energy deficit, tendency toward reduced adaptive resource.	Functional spasms, reaction to environmental load (hypoxia).

ANALYSIS OF VARIANCE (ANOVA) OF RESULTS

The General Energy-Informational Profile demonstrates a relative functional balance across most systems. However, against the backdrop of Autonomic Nervous System (ANS) activation (51.4%), which serves as an indicator of chronic stress loading (Bischof, 2005; Prigogine & Stengers, 1986), two zones of dysfunction were clearly identified: the Musculoskeletal System (MSS) (56.3%) and the Digestive System (54.0%). This correlates with the principles of functional medicine, where elevated indices indicate energy tension or inflammation (Oschman, 2015).

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The simultaneous increase in the activity of these systems may indicate a systemic process or psychosomatic influence via viscero-somatic reflexes, as detailed in energy medicine literature (Yanovsky, 2021).

Summary: Analysis of variance indicates that ANS activation is a marker of chronic stress. The concurrent activation of the MSS and the digestive system may result from viscero-somatic reflexes described in the works on energy medicine (Gotovskiy et al., 2010).

HYPOTHETICAL CORRELATION AND INTERCONNECTION

The simultaneous increase in activity within two key systems (MSS and Digestive) may indicate a systemic pathological process or an interconnected mechanism:

- **Systemic Inflammatory Process:** For example, seronegative spondyloarthritides, which often present with extra-articular (intestinal) manifestations.
- **Psychosomatic Influence:** Chronic ANS activation (51.4%) due to stress can cause increased muscle spasms and gastrointestinal dysfunction through viscero-somatic reflexes.

PROGNOSIS OF POTENTIAL DIAGNOSES

Based on the pronounced elevation of indices in priority systems, the following conditions requiring verification may be hypothesized (Table 2).

Table 2. Prognostic Assessment of Potential Pathological Conditions Based on EIS Deviations

Source: Mataus, N., 2025.

System (EIS Index)	Hypothetical Pathological States and Syndromes	Rationale Based on Energy-Informational Tension Criteria
Musculoskeletal (56.3%)	· Degenerative-dystrophic diseases of the spine (osteochondrosis) with pronounced myofascial syndrome. · Arthritis and arthrosis in the stage of decompensation. · Systemic fibromyalgia.	The index significantly exceeds the homeostasis threshold (>5% from the norm), indicating an active inflammatory phase or high energy cost for maintaining the system's structure.
Digestive (54.0%)	· Chronic gastroduodenitis or colitis in the acute phase. · Irritable Bowel Syndrome (IBS). · Biliary dysfunction (hypertonic type).	Energy excess indicates hypermotility and irritation of the mucosal receptor apparatus against a background of functional tension.
Systemic and Concomitant Disorders	· Psychosomatic disorder: influence of chronic ANS activation (51.4%) on GI motility and skeletal muscle tone. · Systemic inflammation: associated link between intestinal dysbiosis and reactive changes in the joints (enteropathic arthropathies).	The identified simultaneous activation of two key systems (MSS and Digestive) often points to a systemic or interconnected pathological process.

ENERGY PROFILE AND GENERAL CONCLUSION

The profile of the examined cohort demonstrates a relatively balanced functional state for most systems. However, against the background of minimal ANS activation (51.4%), two systems with pronounced energy tension/hyperactivity/inflammation stand out:

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- **Musculoskeletal System (56.3%)** — priority deviation zone.
- **Digestive System (54.0%)** — notable tension zone.

The results of Functional Bio-Resonance Diagnostics (FBRD) obtained via the KRK BARS complex provide information regarding the presence of imbalance in the energy-informational spectrum of the biological systems studied, specifically:

- Priority targets for further medical analysis were identified: MSS and the digestive system.
- Bio-resonance screening was confirmed as an objective tool for assessing systemic functional imbalance correlating with potential pathological states.
- The hypothesis regarding the correlation between changes in energy state and possible functional/pathological conditions of the body was accepted.

IMPORTANT NOTICE

This functional screening is not an independent medical diagnosis. Accurate verification of pathological conditions requires a comprehensive clinical and laboratory examination according to the standards of evidence-based medicine, including:

- **Specialized consultations:** Rheumatologist/Orthopedist, Gastroenterologist.
- **Laboratory markers of inflammation:** C-reactive protein (CRP), Erythrocyte Sedimentation Rate (ESR).
- **Instrumental imaging:** MRI/X-ray of joints/spine, Ultrasound, and endoscopic examination (as indicated).

Recommendations

Repeat monitoring of EIS (Energy-Informational State) indices after corrective procedures can serve as an objective tool for assessing the effectiveness of therapeutic interventions.

Conclusions

This functional screening is not a standalone medical diagnosis. Accurate verification of pathological conditions requires a comprehensive clinical and laboratory examination in accordance with the standards of evidence-based medicine, including:

- **Specialized consultations:** Rheumatologist/Orthopedist, Gastroenterologist;
- **Laboratory markers of inflammation:** C-reactive protein (CRP), Erythrocyte Sedimentation Rate (ESR);
- **Instrumental imaging:** MRI/X-ray of joints/spine, Ultrasound, and endoscopic examination (as indicated).

RECOMMENDATIONS

Follow-up monitoring of EIS (Electronic Interstitial Screening) parameters after corrective procedures can serve as an objective tool for assessing the effectiveness of therapeutic interventions.

CONCLUSIONS

1. **Theoretical Framework:** Biological systems are hierarchically organized entities where E↔I processes are interconnected (Prigogine & Stengers, 1986; Gotovskiy et al., 2010).
2. **Screening Results:** Risk zones were identified in the Musculoskeletal System (56.3%) and the Digestive System (54.0%).
3. **Clinical Interpretation:** Values >50% indicate energy tension, which correlates with published data regarding inflammatory processes (Gotovskiy et al., 2010).
4. **Practical Significance:** The bioresonance screening method is an effective primary monitoring tool for identifying “risk zones” prior to further verification using evidence-based medical methods.

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UNIVERSITY SCIENCE

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UNIVERSITY SCIENCE

SYNERGY BETWEEN ARTIFICIAL INTELLIGENCE AND DIGITAL HUMANISM FOR HUMANITARIAN SECURITY: SUSTAINABLE POST-WAR DEVELOPMENT AND RECOVERY IN UKRAINE

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ABSTRACT

This article explores the synergy between artificial intelligence and digital humanism as a tool for ensuring humanitarian security and sustainable post-war development in Ukraine. The modern digital era is characterized by the rapid development of information technologies, artificial intelligence, and automated systems that are shaping a new sociocultural and economic reality. The aim of the study is to substantiate a conceptual model for integrating the technological potential of AI with the human-centered values of digital humanism in the context of post-war transformation. The methodological basis of the study is an interdisciplinary approach, systemic and structural-functional analysis, as well as a comparative analysis of European AI practices in the humanitarian sphere. Key areas of AI application for improving humanitarian security have been identified, particularly in education, healthcare, social protection, and human capital management. The integration of the principles of digital humanism into digital transformation contributes to reducing social risks, promoting inclusiveness, and increasing the resilience of society. The scientific novelty lies in the formation of a comprehensive vision of the role of AI and digital humanism as a strategic resource for Ukraine's sustainable development in the post-war period, in a comprehensive analysis of the potential of digital technologies and artificial intelligence for integrating humanitarian values into post-conflict recovery processes.

Key words

Artificial intelligence; digital humanism; humanitarian security; sustainable development; post-war recovery of Ukraine; digital transformation.

Classification JEL: O33, H12, P48.

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INTRODUCTION

Ukraine's post-war recovery poses unique challenges for society, combining the need to rebuild physical infrastructure, social stability, and cultural identity. In this context, the issue of humanitarian security becomes particularly relevant—not only as a means of ensuring the physical protection of citizens, but also as a guarantee of the preservation of values, rights, and social cohesion. The current digital transformation, in particular the development of artificial intelligence (AI), opens up new horizons for addressing these issues, allowing for the prediction of humanitarian needs, the optimization of management processes, and the improvement of the effectiveness of social interventions. The relevance of the study is determined by the need to develop conceptual models that combine innovative technologies and ethical, cultural, and social aspects of society's recovery; It is determined by the growing challenges of digitalization in the fields of education, culture, economy, and public administration, which require a systematic approach to ensure sustainable development and the safe functioning of society (Masiuk, El Guessab, Sorokina, O., 2023).

The aim of the work is to identify strategic directions for the integration of AI and digital humanism to enhance humanitarian security, develop inclusive social mechanisms, and support the sustainable development of the national community in the post-conflict period. In the current context of societal transformation under the influence of digital technologies and artificial intelligence, there is an urgent need to develop new concepts of humanitarian security and sustainable development. This is especially true for Ukraine in the post-war period, when the processes of restoration and stabilization of socio-economic, cultural, and educational systems require the integration of innovative technologies with a humanitarian approach. At the same time, technological progress carries potential risks of dehumanizing society. Therefore, the integration of the principles of digital humanism is becoming a key condition for ensuring a balance between innovation and human values. Digital humanism emphasizes a human-centered approach, the ethical use of technology, and the formation of a cultural and value-based environment in which AI serves not only as a tool for efficiency but also as a mechanism for supporting social justice (Van Dijk, 2020).

Thus, the object of the study is the interaction of artificial intelligence and digital humanism in the processes of humanitarian security and post-war development of Ukraine, and the subject is the mechanisms and practices of integrating digital technologies to ensure the sustainability and effectiveness of recovery processes in various spheres of public life.

The scientific novelty of the study lies in a comprehensive analysis of the potential of digital technologies and artificial intelligence for integrating humanitarian values into post-conflict recovery processes. The research demonstrates the possibilities of combining technological progress with the principles of social responsibility, environmental sustainability, and a humanistic approach to the development of society. Particular attention is paid to the creation of models of digital humanism that allow technological innovations to be transformed into mechanisms for supporting social justice, cultural integration, and environmental restoration.

The scientific problem lies in identifying ways to synthesize the technological potential of AI and the humanistic principles of the digital age to ensure the sustainable and comprehensive post-war development of Ukraine.

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The issues include analyzing the effectiveness of digital tools in restoring infrastructure, social networks, and the ecological system, as well as researching how digital technologies can contribute to the formation of an inclusive and responsible society where technological innovations serve not only economic growth but also humanistic and ecological goals.

Thus, the object of the study is the interaction of artificial intelligence and digital humanism in the processes of humanitarian security and post-war development of Ukraine, and the subject is the mechanisms and practices of integrating digital technologies to ensure the sustainability and effectiveness of recovery processes in various spheres of public life.

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The scientific problem lies in identifying ways to synthesize the technological potential of AI and the humanistic principles of the digital age to ensure sustainable and comprehensive post-war development in Ukraine. The issues include analyzing the effectiveness of digital tools in restoring infrastructure, social networks, and the ecological system, as well as researching how digital technologies can contribute to the formation of an inclusive and responsible society where technological innovations serve not only economic growth but also humanistic and ecological goals.

LITERATURE REVIEW

Current research in the field of digital technologies and artificial intelligence (AI) emphasizes their ability not only to improve the efficiency of economic and management processes, but also to transform the social, cultural, and environmental aspects of society's development. Research by Tapscott (2014) and Chen et al. (2021) shows that digitalization and automation can ensure transparency, speed, and accuracy in post-conflict recovery programs, contributing to the restoration of critical infrastructure and resource optimization. An important direction is digital humanism, which views technology as a tool for supporting social values. Drucker's (1993) work demonstrates that digital platforms and AI can be integrated into social processes in ways that promote social justice, cultural integration, and environmental sustainability. This is particularly relevant in post-conflict regions, where the restoration of social systems requires not only physical resources, but also the restoration of trust and the social fabric (Masuda, 1981).

International experience shows the successful application of digital technologies in post-conflict reconstruction. For example, in Rwanda after the genocide, digital databases and geographic information systems were used to restore public infrastructure and monitor reconstruction projects. In Iraq and Syria, digital platforms were used to provide access to humanitarian aid and coordinate the activities of international organizations, increasing the efficiency of resource distribution. Artificial intelligence is becoming a key tool in predicting the needs of affected populations and

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optimizing the logistics of humanitarian operations. Nick Bostrom (2002: 2005; 2011) emphasizes that AI algorithms allow for the analysis of large amounts of data to make effective management decisions, including risk assessment, recovery planning, and the integration of environmental strategies. At the same time, N. Negrapotene (1995) highlights the potential risks of digitalization, in particular the threat of social inequality, technocratization, and the possibility of neglecting humanistic values if technologies are applied without an ethical framework.

Research by Ukrainian scientists (Voronkova, Nikitenko, 2025) demonstrates that in the context of the country's post-war development, there is a need to create models that integrate digital technologies and humanistic principles. Particular attention is paid to the use of digital platforms to restore social ties, ensure the transparency of government programs, and support cultural heritage. However, there is still a lack of comprehensive approaches that combine technological potential with social responsibility and environmental sustainability (Poster, 1990). Thus, the literature review indicates the relevance of integrating digital technologies and AI into post-conflict reconstruction, where they serve not only as economic and management tools, but also as a means of supporting humanistic values, social justice, and environmental sustainability. This gap in scientific knowledge determines the relevance and necessity of this study for the development of conceptual and practical mechanisms of digital humanism in Ukraine (Nikitenko, Voronkova, Oleksenko, Andriukaitiene, Pyurko, & Khrystovoi, 2025).

RESEARCH OBJECTIVE

The objective of the research is to comprehensively study the potential of digital technologies and artificial intelligence as tools for integrating humanistic, social, and environmental values into the processes of post-conflict reconstruction in Ukraine. The study involves the formation of conceptual and practical approaches to ensuring sustainable development that combines technological innovation with social responsibility, environmental balance, and cultural identity in the context of global digital transformation and a postmodern vision of human-technology interaction.

To achieve this goal, the following research tasks have been identified:

1. Conduct a comprehensive analysis of the potential of digital technologies and AI for post-conflict reconstruction in Ukraine, assessing their impact on sociocultural, economic, and environmental processes.
2. Identify opportunities for integrating humanistic and environmental values into digital processes, thereby forming a value-oriented model of digital humanism.
3. Study international experience in the application of digital technologies in post-conflict regions, analyzing successful practices and lessons for adaptation to the Ukrainian context.
4. Develop conceptual approaches and practical recommendations for the application of digital humanism to ensure sustainable development, social justice, and cultural identity.

METHODOLOGY

The research methodology is based on a comprehensive combination of phenomenological, axiological, postmodernist, and agile approaches, which allows digital technologies and artificial intelligence to be considered as sociocultural, economic, and humanistic phenomena simultaneous-

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ly. This approach provides an opportunity for in-depth analysis of digital processes in Ukraine's post-conflict recovery, taking into account the value, ethical, and cultural aspects of their impact. The phenomenological method allows us to study the experience of participants in the recovery process, the perception of technologies and AI as tools for humanistic development, and to determine the significance and value of digital innovations for different social groups. The axiological approach provides a systematic assessment of the moral, cultural, and environmental priorities underlying digital transformations and determines their impact on the sustainable development of society. The postmodernist perspective allows us to deconstruct traditional ideas about regulation, standards, and management models by viewing digital processes as a network of local practices, individual strategies, and context-dependent decisions. It emphasizes the multiplicity of interpretations and flexibility in applying global experience to the Ukrainian context (Polanyi, 1958).

The agile approach is integrated as a practical research tool that involves iterative data collection and analysis, rapid model adaptation, and testing of conceptual solutions, enabling a rapid response to changing conditions in post-conflict processes and digital transformation. In terms of methodology, the study uses the following methods: 1) Theoretical analysis – studying scientific sources, concepts of digital humanism, creative industries, and post-conflict recovery. 2) Phenomenological analysis – studying the subjective experience of participants in recovery and their perception of digital technologies. 3) Comparative analysis – studying international experience in the application of digital technologies in post-conflict regions and adapting best practices to Ukrainian conditions. 4) Systemic approach – comprehensive analysis of the interaction of technologies, institutions, economic and cultural factors in recovery processes. 5) Critical analysis – assessment of the risks and challenges of digitalization, social inequality, ethical issues, and development of recommendations for their minimization. 6) Synthesis and modeling – formation of conceptual approaches and practical recommendations for the application of digital humanism for the sustainable development of Ukraine. Thus, the proposed methodology provides a holistic and multidimensional approach to the study of digital technologies and AI in post-conflict reconstruction, combining scientific rigor with philosophical depth, value orientation, and practical significance for the formation of effective digital humanism policies in Ukraine (Lepskyi, Kudinov, Lepska, & Rustesky, 2023).

RESULTS AND DISCUSSIONS

1. Comprehensive analysis of the potential of digital technologies and AI for Ukraine's post-conflict recovery.

Digital technologies and AI as fundamental factors in Ukraine's post-conflict recovery are developing between philosophy, innovation, and sustainable development. Post-conflict recovery is not only the reconstruction of destroyed infrastructure, but also a profound socio-cultural, economic, and environmental transformation of society. In the modern era of information and digital technologies, reconstruction cannot be effective without the use of innovative digital tools and AI, which are becoming the synergistic core of the restoration of state and social systems. These tools not only accelerate the reconstruction of physical objects, but also contribute to the

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formation of a new quality of social life, the democratization of public administration, economic growth, and sustainable environmental development.

Sociocultural dimensions of digital recovery (Luhmann, 1990). Digital services, in particular government e-government platforms, are radically changing the interaction between citizens and the state, strengthening democracy and social capital. They help engage communities in decision-making, monitor reconstruction projects, and provide real-time access to information on the progress of recovery efforts. This creates the basis for an innovative public sphere where accountability, participation, and trust are not by-products but key outcomes of digital transformation. Inclusiveness and preservation of cultural identity. Digital technologies facilitate access to education, healthcare, and cultural resources regardless of geographical and social barriers. Educational platforms, online communities, and digital documentation of cultural heritage contribute to the preservation of national identity and the restoration of social ties in communities that have experienced the trauma of war. Monitoring and managing social challenges. AI tools enable the analysis of large amounts of data on demographic changes, population needs, migration processes, and psychological health. Such analysis can provide predictive modeling of social risks, which is particularly important for the reintegration of internally displaced persons, the development of a social support system, and the adaptation of educational and cultural services (Jameson, 1991).

Digital technologies are the foundation of a society that is transitioning from the use of material resources to information resources. They create new industries, optimize business processes, increase competitiveness in the global market, and promote Ukraine's integration into the digital economy of the EU and the world. AI-based systems enable the automation of budget planning, reconstruction logistics, damage assessment, and forecasting of financing needs, which is critical for the smart allocation of limited resources. The use of data analysis and modeling algorithms significantly reduces bureaucratic costs and increases the efficiency of public and private investments. The IT sector is becoming one of the most important drivers of the economy, creating highly productive jobs. The integration of digital solutions into industry, agriculture, logistics, and financial technologies generates a multiplier effect for GDP.

In addition, digital platforms facilitate Ukrainian companies' entry into global markets by stimulating exports of services and intellectual capital. AI-based satellite surveillance systems, drones, and sensor networks are capable of continuously monitoring air and water quality, soil pollution levels, forest landscapes, and water resources. This not only allows for a rapid response to environmental threats, but also provides a quantitative analysis of the long-term effects of war on ecosystems. The deployment of digital solutions that optimize energy consumption and network management contributes to reducing greenhouse gas emissions in rebuilt regions. However, the development of AI and data centers also creates an additional burden on the energy sector, which requires green energy and decarbonization strategies. Blockchain technologies and digital platforms can ensure fully transparent tracking of environmental parameters and the use of environmental resources, increasing the responsibility of both the state and business for their impact on the environment (Hassan, 2020).

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2. Integrating humanistic and ecological values into digital processes: forming a value-oriented model of digital humanism.

The modern digital era is characterized by the rapid development of information technologies, artificial intelligence, and automated systems that are shaping a new sociocultural and economic reality. Along with this, there is a critical need to rethink the place of humans in the digital environment, their values, rights, and ethical guidelines. This is where the scientific concept of digital humanism becomes a key tool for combining technological progress with humanistic and ecological priorities. As Floridi (2013) notes, information ethics is fundamental to the creation of digital systems that not only function effectively but also meet social and humanistic standards.

Digital humanism involves reorienting technological processes toward people, their well-being, social justice, and environmental sustainability. A critical analysis of Harari's work shows that modern digital platforms can and should include mechanisms that ensure algorithm transparency, ethical data use, and support for socially important initiatives. This means that the development of artificial intelligence and digital technologies cannot take place in isolation from the needs of society and environmental challenges, but rather must integrate value-oriented principles into all aspects of its implementation (Harari, 2018).

The integration of humanistic values into digital processes primarily involves the ethical design of algorithms and systems. Transparent algorithms that are subject to social control ensure fairness, protect human rights, and minimize the risk of discrimination. At the same time, digital platforms should promote critical thinking, develop digital literacy skills, and raise citizens' awareness of their social and cultural responsibilities in the digital space. Thus, digital humanism becomes not only a technical or engineering task, but also a philosophical and value-based approach that shapes users' conscious attitude towards technology.

The environmental dimension of digital humanism includes the conservation of natural resources and support for sustainable development through digital tools. Modern technologies make it possible to create systems for monitoring environmental processes, predicting the negative consequences of human activity, and optimizing the use of resources. Latour's works emphasize the importance of eco-oriented solutions in digital systems that reduce the energy load on the environment, including "green coding" and energy-efficient computing platforms. This approach not only meets environmental priorities but also promotes social responsibility among users and companies that develop digital products (Latour, 2005).

Based on these principles, a value-oriented model of digital humanism is formed, which includes four interrelated components: Humanistic – priority of the individual, their education, development, social equality, and cultural self-expression. Ecological – protection of the environment, responsible use of natural resources, implementation of sustainable development technologies. Technological – innovative digital tools that support social and environmental values and ensure transparency and effective management. Ethical – guaranteeing transparency, accountability, and protection of user rights, integrating moral principles into algorithmic decisions. Thus, digital humanism is a philosophical and practical paradigm that combines technological efficiency with a value orientation towards people and the environment. Its implementation is a necessary condition for the sustainable

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and harmonious development of modern society, particularly in the context of post-conflict reconstruction, where digital technologies can become a tool for integrating humanistic and environmental values into all spheres of social, economic, and cultural activity (Getman, Danilyan, Dzeban, & Kalynovskyi, 2023).

3. International experience in the application of digital technologies in post-conflict regions and lessons for adaptation to the Ukrainian context.

International experience shows that digital technologies in post-conflict regions are not just a technical tool, but a key factor in the restoration of state institutions, the economy, and social stability. The experience of European Union countries is particularly indicative, where digitalization has become an important component of crisis management strategies, infrastructure reconstruction, and strengthening social cohesion. The EU is developing an approach that combines technological solutions, integrated management, and a humanitarian component to ensure effective and sustainable post-conflict recovery (Maclup, 1962).

The United Kingdom, France, Germany, and Scandinavian countries have actively used e-government, digital platforms for coordinating humanitarian aid, geographic information systems (GIS) for assessing damage, and remote monitoring tools in their experience of recovering from local crises. For example, after numerous internal crises, Germany introduced integrated digital management systems for cities and regions that allow tracking infrastructure facilities, planning repairs, and coordinating the activities of various public and private structures. This significantly increases cost efficiency and minimizes the risk of repeated losses (Merton, 1968).

EU countries also pay considerable attention to digital platforms for civic participation and restoring social trust. For example, the Estonian e-governance model demonstrates how digital services integrated into the state system increase transparency, reduce corruption risks, and ensure continuity of service delivery, even in crisis conditions. Similar approaches have been adapted to the specificities of other European countries and can be used as a basis for creating a Ukrainian digital recovery platform that includes electronic business registration, social payments, and access to medical and educational services.

An important component is the use of digital technologies for economic recovery. Many EU countries, such as Sweden and Finland, use platforms to support small and medium-sized businesses through digital services, electronic payments, and online tax systems, which helps accelerate the recovery of economic activity in post-conflict regions. This emphasizes that digitalization, combined with effective financial management and a favorable business environment, can serve as a catalyst for economic growth (Drucker, 1993).

The EU also actively uses digital technologies to preserve cultural heritage and education in post-conflict regions. For example, the EU4Culture program uses innovative digital platforms to restore architectural sites, museums, and libraries, which not only preserves historical memory but also stimulates tourism and the creative economy. Distance learning, digital courses, and retraining programs make it possible to quickly improve human capital and the population's readiness to participate in recovery and development processes.

Another important lesson from the European experience is the coordination of actions at the international level through digital platforms, in particular for managing humanitarian flows, monitoring the situation, and exchanging data between states and inter-

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national organizations. ICT4Peace and other EU initiatives demonstrate how information technology creates transparent and effective channels of interaction between different stakeholders.

This experience is extremely important for Ukraine. The main lessons that can be adapted to the Ukrainian context include:

Prioritizing the restoration of digital infrastructure to ensure communication and the functioning of public services.

Introducing e-government systems and platforms for citizen participation to increase transparency and management efficiency.

Using digital tools to monitor and assess damage, allowing for reconstruction planning with minimal resource loss.

Creation of digital platforms to support business and economic recovery.

Integration of digital solutions in education, retraining, and cultural heritage preservation.

Ensuring coordination between the state, civil society, and international partners through digital platforms.

Thus, the experience of EU countries shows that digital technologies are a universal tool for the comprehensive recovery of post-conflict regions, combining economic, social, cultural, and managerial aspects, which Ukraine can effectively adapt to its needs.

4. Conceptual approaches and practical recommendations for applying digital humanism to ensure sustainable development, social justice, and cultural identity.

In today's world, where digital technologies are becoming an integral part of social, economic, and cultural development, the issue of integrating humanistic principles into the digital sphere is becoming particularly relevant. The concept of digital humanism offers a synthesis of technological progress and values that form the basis of social justice, cultural identity, and sustainable development. In this context, digital humanism acts not only as a methodological framework, but also as a practical tool capable of transforming social processes, ensuring the harmonious coexistence of technological and humanitarian dimensions. One of the key approaches to applying digital humanism is the integration of ethical and cultural standards into digitalization processes. This involves the development of algorithms and platforms that take into account not only efficiency and economic feasibility, but also the social and cultural consequences of their implementation (Ninet, 2019).

An important aspect is the formation of "digital etiquette," which encourages responsible use of technology, promotes social inclusion, and minimizes the risks of digital inequality. To ensure sustainable development, digital humanism offers conceptual approaches that combine innovative technologies and environmental awareness. The use of artificial intelligence and analytical platforms in resource management allows for the prediction and optimization of production, consumption, and natural resource recovery processes, while preserving the cultural traditions and social values of local communities. This approach creates conditions for the formation of an economy based on the principles of circularity, energy efficiency, and social responsibility in the context of the Fourth Industrial Revolution (Schwab, 2016). Social justice within the framework of digital humanism is achieved through the development of policies and technological solutions that ensure equal access to information, education, and cultural resources. For example, the creation of open digital libraries, educational platforms, and virtual cultural centers contributes to the democratization of knowledge and the preservation of

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cultural heritage. Importantly, such initiatives support cultural identity by enabling citizens to preserve and transmit their own traditions in the global digital space (Deleuze, 1990).

Practical recommendations for applying digital humanism include:

1. Developing ethical standards and regulations for designing digital platforms and applications that take into account human rights and cultural characteristics.
2. Implementing digital monitoring systems for the social impact of technologies to prevent digital discrimination and marginalization of vulnerable groups.
3. Creating interdisciplinary centers that bring together experts in digital technologies, sociology, philosophy, and cultural studies to develop strategies for sustainable digital development.
4. Integration of educational programs aimed at developing digital literacy, critical thinking, and cultural awareness in order to educate citizens capable of interacting responsibly with technological systems.
5. Use AI technologies to optimize resource management and support environmentally sustainable solutions, while preserving the cultural and social value of local communities.

DISCUSSIONS

Digital humanism emerges as a fundamental strategy for integrating technological progress with humanistic values. Tapscott's conceptual approaches and practical recommendations not only ensure social justice and sustainable development, but also contribute to the preservation of cultural identity, shaping a society capable of harmoniously combining innovation and humanity in the digital age (Tapscott, 2014). In the modern era, digitalization is becoming a fundamental factor in the transformation of society, the economy, and culture. The emergence of digital humanism opens up a new dimension of human-technology interaction, where technological progress does not contradict humanistic values but serves to realize them. As emphasized by V. Nikitenko, V. Voronkova, and others, digital humanism emerges not only as a methodological framework but also as a practical tool capable of ensuring social justice, preservation of cultural identity, and sustainable development in a post-conflict and globalized world (Nikitenko, Voronkova, 2025).

Digital humanism integrates ethical, cultural, and social standards into digitalization processes, which helps avoid technocratic determinism and shapes human-centered technologies. Bourdieu proposes six ethical principles of digital humanism: human dignity, inclusion, autonomy, transparency, responsibility, and social justice (Bourdieu, 1986). However, critics, notably L. Floridi, emphasize the need for critical analysis of political and social aspects, as digital systems have the potential for control, manipulation, and increased inequality (Floridi, 2011).

In practical terms, digital humanism manifests itself through specific cases. In Ukraine, an example is the "Дія.Цифрове місто" (Action.Digital City) project, which integrates electronic services for citizens, ensuring transparency, accessibility, and protection of personal data. This approach demonstrates a combination of digital inclusion and social justice, providing citizens with equal access to state services. Similarly, in the EU, the European Digital Humanism initiative, supported by the universities of Vienna and Amsterdam, focuses on developing ethical standards for artificial intelligence, taking into account human rights and cultural characteristics of different

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countries, which serves as an example of the European model of humanizing the digital space (Zuboff, 2019).

Social justice within the framework of digital humanism is achieved by ensuring equal access to information, education, and cultural resources. Open digital libraries and educational platforms are being created in Ukraine and the EU, allowing citizens from different regions and social groups to preserve their cultural identity and develop their creative potential. For example, the Virtual Library of Ukrainian Heritage platform provides access to historical, cultural, and educational materials, helping to preserve national identity in the context of digital globalization.

In the field of sustainable development, digital humanism is implemented through the introduction of artificial intelligence and big data technologies to optimize resource management and energy conservation. In Ukraine, this is manifested in the Smart Agriculture and Green Energy 4.0 projects, where digital platforms help predict harvests, use water resources efficiently, and integrate renewable energy sources while preserving the cultural traditions of rural communities. In the EU, similar initiatives are being implemented as part of the Horizon Europe and Green Digital Europe programs, which combine digital innovation and environmental standards (Danilyan, Dzoban, & Kalynovskyi, 2023).

The practical application of digital humanism involves:

1. Developing ethical standards for the design of digital systems and algorithms that take into account human rights and cultural characteristics.
2. Introducing mechanisms for assessing the social impact of technologies to prevent digital inequality and the marginalization of vulnerable groups.
3. Creating interdisciplinary centers for developing sustainable digital development strategies that bring together specialists in technology, the humanities, and cultural studies.
4. Integrating educational programs focused on digital literacy, critical thinking, and cultural awareness.
5. Use AI and analytics technologies to support the circular economy, energy efficiency, and socially responsible business.

Thus, digital humanism emerges as a fundamental strategy for integrating technological progress and humanistic values. Its conceptual approaches and practical implementations in various spheres in Ukraine and the EU demonstrate that the combination of innovation and humanity can ensure social justice, sustainable development, and cultural identity in the digital age (Utiuzh, Sajtarly, & Pavlenko, 2020).

CONCLUSIONS

Based on the analysis, it can be argued that digital humanism is emerging as a fundamental paradigm of the modern era, capable of combining technological progress with humanistic values and socio-cultural orientations. It is not just a theoretical concept, but also a practical tool capable of transforming social processes, ensuring harmonious interaction between people, technologies, and the environment. Digital humanism allows us to critically rethink the role of technology in modern society, moving away from purely technocratic determinism and bringing to the fore the values of humanity, autonomy, inclusion, and social justice.

A philosophical analysis of contemporary approaches demonstrates that digital humanism is not a homogeneous or apolitical phenomenon. As Mark Koukelberg and Erich Prem

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emphasize, it involves an awareness of the political and social dimensions of technology, including its potential for control, manipulation, and digital inequality. At the same time, its practical implementation in various spheres in Ukraine and the EU — from government e-services to environmental digital platforms and educational initiatives — demonstrates the ability of digital humanism to ensure access to knowledge, preserve cultural identity, and support sustainable development and social inclusion.

Digital humanism forms a new ethical and cultural framework for the development of society, in which technology ceases to be merely a tool for economic efficiency and becomes a means of realizing humanistic values. It allows technological innovations to be integrated with social and cultural needs, creating conditions for a circular economy, energy efficiency, environmental stability, and social responsibility. This highlights the need for an interdisciplinary approach that brings together experts in digital technology, sociology, cultural studies, philosophy, and ethics to develop strategies that ensure the harmonious development of society in the digital age.

Particular attention should be paid to the cultural aspect of digital humanism. Preserving and transmitting cultural identity in a globalized digital space is not only a matter of identity, but also a key factor in social stability and the integration of local communities into global processes. Digital platforms, educational resources, and cultural initiatives implemented in Ukraine and the EU demonstrate the possibility of synthesizing technological progress and humanitarian values, ensuring equal access to knowledge and cultural heritage for all categories of citizens.

Thus, digital humanism acts as a strategy capable of combining innovative development with the principles of humanity, ethics, and social responsibility. Its application creates conditions for the development of a society in which technology serves people, not the other way around, ensuring social justice, cultural identity, and sustainable development. It shapes a new type of social thinking focused on the integration of science, culture, ethics, and technology, making digital humanism not only a conceptual framework but also a practical basis for the transformation of the modern world.

Therefore, it can be argued that digital humanism is not just a response to the challenges of the digital age, but a philosophical platform that opens up new horizons for the development of individuals, society, and culture, forming an ethical, social, and cultural foundation for a sustainable and harmonious future.

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Formal analysis: Vitalina Nikitenko
Funding acquisition: Vitalina Nikitenko
Investigation: Vitalina Nikitenko
Methodology: Valentina Voronkova
Project administration: Valentina Voronkova
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