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GREEN CAMPUS IN THE UNIVERSITIES OF THE WORLD

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The aim of the article is to analyze the world practice of implementing Green Campuses programs in higher education institutions and assess the possibilities of practical implementation of the principles of sustainable development in Ukrainian universities. The following methods were used in the study: retrospective analysis – in considering the main stages of thegreen campusesconcept evolution, system-structural analysis – in substantiating and building a five-support structure of eco-campus, comparative analysis – in presenting examples of effective organization Green campuses on a global scale. The article emphasizes that universities around the world support the mission of providing future professionals with quality education that will promote the adequate development of student skills for the benefit of the community and the state. Therefore, the values that are incorporated by certain institutions of higher education are an essential factor that guides entrants when choosing a place of study. In this context, more and more universities on a global scale have begun to pay attention to the importance of including environmental friendliness and resource efficiency as an integral part of their corporate culture and even architecture. The aim of this environmental initiative is to create an ideological basis for students who would live environmentally sustainable activities as a daily practice. Along with environmental benefits for humans and the environment, green campuses bring economic, social, and reputational benefits to following universities. The authors of the article derived a five-pronged structure of green campuses, which is the basis of theoretical and conceptual provisions for the greening of educational activities. Yes, this structure provides the following system components as green administration of free economic zone, greening of educational and methodical activity, scientific and innovative activity in the field of green economy, ecological education of students and partnership for the purposes of sustainable development. The article presents global examples of effective organization of "green campuses" with justification of practical results. The UI GreenMetric rating system, in which Sumy State University became a participant, was detailed and briefly described, taking second place due to its pro-environmental activity, which is systematic and strategic.

Keywords: *green campuses, sustainable development goals, green education, resource efficiency, rational use of nature, international rating system, leading universities.*

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INTRODUCTION

Today, solving global environmental problems is one of the key challenges facing the world community. The need to move to sustainable development has led to the consolidation of efforts of public authorities, international organizations and stakeholders to implement environmental initiatives at the local, national and global hierarchical levels of government.

Universities are no exception and, like everyone else, become more proactive on green issues. Higher education institutions have long been agents of change and have transformed from traditional learning centers into centers of modern development and innovation. Universities not only train professionals, but also act as global players outside the purely educational space, joining global environmental projects and programs. Education has been described as the best hope of humanity and the most effective means of achieving sustainable development. In this context, universities have a special responsibility to society and future generations. Their mission is to become centers of sustainable development, which can be achieved through learning channels and the organization of scientific developments in the field of environmental management.

The effectiveness of the implementation of the concept of green university is assessed by such indicators as green infrastructure (e.g., Cambridge University in the UK, Vienna University of Economics), energy saving (e.g., Georgetown University, Carnegie Mellon University (USA)), Middle East University of Technology in Turkey), storage and recycling of waste (e.g., Cork University in Ireland, University of Newcastle in the UK), use of environmentally friendly transport (e.g., Technical University of Berlin), organization of trainings on environmental seminars (e.g., Princeton University in the USA), research in relevant fields (University of Manchester in the UK, Auckland University in the US), etc. The accumulated foreign experience can become a reference point for Ukrainian universities. Thus, Ukraine is already implementing the Energy Efficient Campus Program under the District Heating Reform Project in Ukraine with funding from the United States Agency for International Development (USAID). Therefore, the relevance of this issue led to the choice of research topic.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

The research in the field of green campuses is represented mainly by foreign publications. Thus, the impact of eco-campuses on the quality of life of students and teachers is analyzed in the works of R. Tiyarattanachai and N. Hollman [1]. The connection between green campuses and the goals of sustainable development is established in the work of B. Zhu, C. Zhu and B. Dewancker [2]. Green university initiatives as a strategy to spread the principles of sustainable development in the education and training of students are studied in the work of many scientists [3]. Many works are devoted to local research of green campuses in the universities of Indonesia [4], China [5] and others. A generalized assessment of the foreign experience of arranging eco-campuses is given in the work of Yu. Podoprigora, T.V. Zakharova, D. Kroza[6]. Paying tribute to these studies, we propose to consider the best practices of green campuses in universities around the world through the prism of combining environmental priorities and practical results to maximize the potential benefits for Ukrainian universities.

STATEMENT OF THE PROBLEM

The aim of the article is to analyze the world practice of implementing Green Campuses programs in higher education institutions and assess the possibilities of practical adoption of sustainable development principles in Ukrainian universities.

RESEARCH METHODS

The following methods are used in the study: retrospective analysis in considering the main stages of the green campusesconceptevolution, system-structural analysis – in substantiating and building a five-support structure of eco-campus, comparative analysis – in presenting examples of effective green campuses organization on a global scale.

RESEARCH RESULTS

Sustainable development requires changes in thinking and ways of doing things, with education playing a key role in ensuring such transformations. Education for Sustainable Development (ESD) is not only a prerequisite for achieving a sustainable future, but also a

priority and anticipatory tool, i.e., the transition to SD begins with the formation of education for sustainable development and the formation of a new globally sustainable consciousness.

The course for the universities transformation in the direction of sustainable development began in the 90s of the twentieth century and covered two revolutionary waves. During the first wave, a general vision was developed and the need to introduce innovations has become more urgent to reduce anthropogenic pressure on the environment on campus was highlighted. Campuses were positioned with built energy-efficient buildings that provide students and teachers with organic food, equip a network of bicycle paths and more. Universities experimented with a variety of Green Campus projects on a global scale, leading to the emergence of world-renowned leaders in this field in the 1990s. However, the problem was that despite the fact that the indicators improved significantly, the universities did not achieve a deep, fundamental transformation [7]. The second wave of ecological transformation of universities beganin 2003-2004. It was characterized by pressure from environmental lobbies and public involvement, as well as the formation of an environmental administration structure, usually by a special committee of teachers and students. These efforts have focused on transforming the university sector from individual environmental projects to sustainable progress to achieve large-scale environmental goals. Less than 2% of universities had sustainable development committees, and by 2008 this figure had reached 50% [8] in 2001.

According to the authors, the concept of a "green campus" has a five-fold structure (Fig. 1).

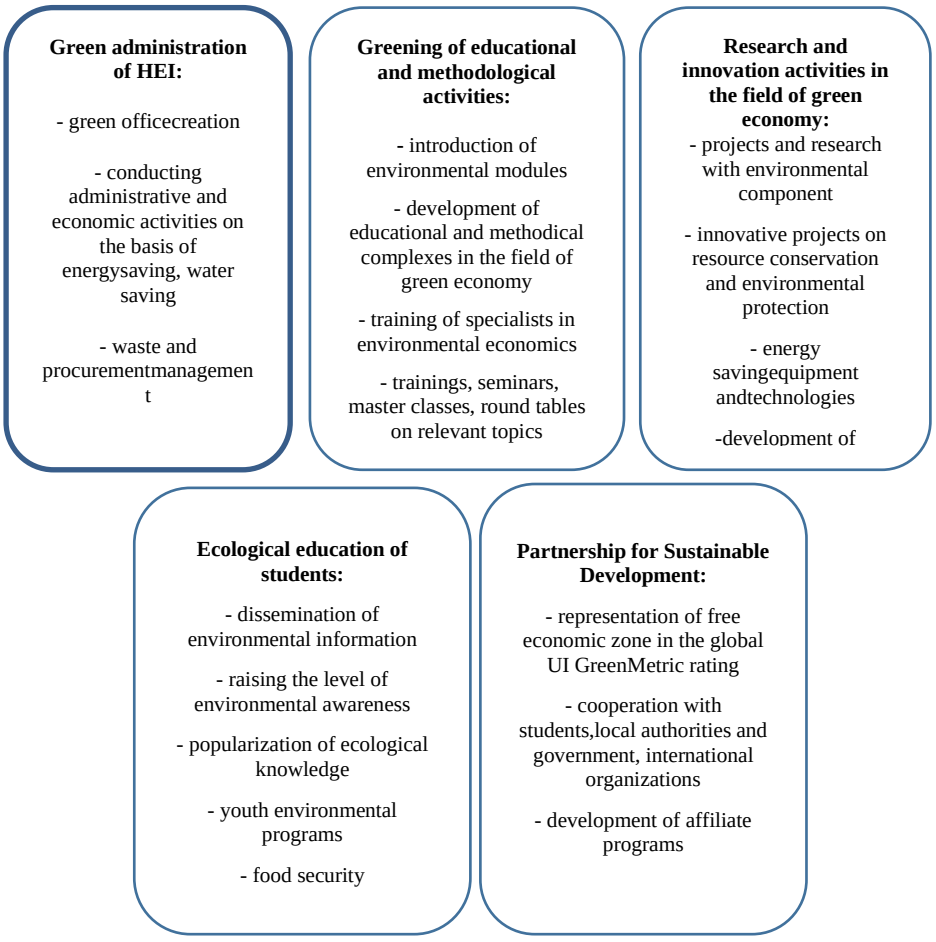

Figure 1 – Five-support structure of the green campus (author's development)

According to the above structure, the main tasks of creating a green campus in higher education institutions are the following[9, pp. 61-62]:

1. Carrying out institutional and social changes in primary schools, which lead to the creation of fundamentally new structures – green offices – centers aimed at implementing corporate environmental policy in educational institutions. It is planned to administer the educational institution based on energy and resource conservation, waste collection and disposal, creation of eco-parks, etc.

2. Integration of sustainable development issues into the educational process through curricula, development and publication of educational and educational literature. It is planned to improve environmental education, organize thematic seminars, trainings, special courses, competitions, debates, round tables, etc.

3. Development of scientific activity in the field of green development through participation in initiatives aimed at improving energy efficiency, creation and use of energy-saving equipment and biosphere-compatible technologies.

4. Comprehensive development of green education and environmental culture of youth. It is envisaged to create opportunities for students and staff of the institution to acquire skills of socially responsible behavior aimed at sustainable development in conditions of national and cultural diversity through the development of ecotourism, volunteer movement, youth events, flash mobs and others.

5. Cooperation and partnership programs development with other organizations for the purposes of sustainable development. It is difficult for an educational institution to implement environmental activities and programs on its own, so the concept of the green office provides for partnership programs and cooperation of universities with commercial and public organizations, government agencies at the regional and international levels.

The creation of green office in educational establishment is based on the concept of 3R − three important basic principles, which have already been mentioned above:

- reduction − the principle of economy (reduction of consumption of electricity, water and other resources);
- refinement − the principle of materials reuse (rational use of paper, etc.);
- replacement –the replacement of some products with more environmentally friendly ones (minimization of negative impact on the environment due to a more responsible approach to the choice of goods, services, etc.).

World examples of effective organization of green campuses are given in the Table 1.

Table 1 – World examples of effective organization of green campuses (compiled by the authors of [9, pp. 48-50])

University	Country	Practical results
Princeton University	США	The reduction of CO2 emissions, resources saving, research projectsand public involvement are among the selected priorities. Investments in the amount of 5.3 million dollars were aimed at electricity saving and projects to reduce emissions. An additional $ 45 million have been invested in energy efficient projects. Thanks to these measures, the following effects were achieved: energy savings of $ 1.7 million per year, and CO2 emissions were reduced by 10,000 tons; water use in dormitories decreased by 30%; reduction of paper use by 29%, and 83% of purchased paper was non-primary use. The revision of the curricula led to an increase in the number of graduate students in environmental specialties by 300%, and 50 disciplines contained a component of sustainable development.
University of New South Wales	Australia	An efficient use of resources and research projects working closely with the local community are among the selected priorities. Investments amounted to 81,6 million dollars. The result of these investments was the construction of a 6-storey TETB building, which received 6 stars (world leader) from the Committee on Environmental Construction of Australia. Its laboratories conduct research on photovoltaic solar technologies, renewable energy sources, energy economics, etc. A third-generation plant has been installed in the building, which supplies electricity to nearby facilities.
The University	Canada	Improving the environmental friendliness of infrastructure, greening of the university and interaction with the public are among the selected priorities. Investments amounted to 37 million dollars. Investment Effects: The University

University	Country	Practical results
of British Columbia		Building Center for Interactive Research on Sustainability, the "greenest" green building in North America with positive energy consumption, a closed water system with 100% access to daylight, is used as a platform and laboratory to test building performance and systems for the construction of environmentally sustainable buildings.
Middle Eastern Technical University	Turkey	Campus landscaping, close cooperation with local residents, involvement of students are selected priorities. The university is a key executor of a large-scale program on landscaping and landscape planning. Students, support staff and graduates plant 20,000 trees every year. The flora of HEI includes 250 species of plants. Only local building materials are used in the construction of buildings. Every year the university holds a festival of afforestation.
Tongji University	China	The University initiated the creation of the China Green University Network, which consists of 8 leading universities and 2 research centers. R&D, transition to green infrastructure, interaction with the local community, student involvement are among the selected priorities. Investments in the innovative system for energy management CEMS amounted to $ 1.3 million, 762 million dollars was aimed at buildings improvement. Investment results: introduction of CEMS, which allows monitoring energy use at the university, including online. Student activists modeled a bamboo house on solar panels, 91 curricula with elements of green development in the initial plan were also developed.

According to the global ranking network UI GreenMetric World University Rankings, the following universities were the leading higher education institutions that have actively joined the green educational initiatives in 2021 (Table 2).

Table 2 – The world's leading green universities in 2021[10]

№	University	Country	Score
1	Wageningen University	Netherlands	9300
2	University of Nottingham	Great Britain	8850
3	University of Groningen	Netherlands	8800
4	University of Nottingham Trent	Great Britain	8750
5	University of California, Davis	USA	8750

In total, 956 universities participated in the authoritative UI GreenMetric ranking for 11 years of its public publication (Fig. 2), which indicates a trend towards sustainable initiatives in the educational environment.

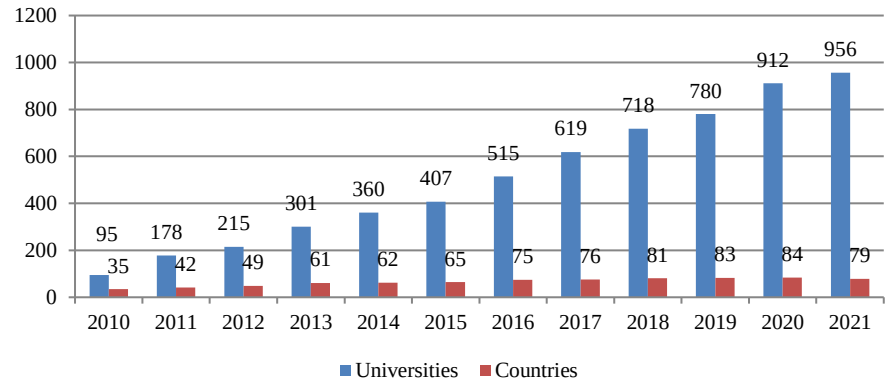

Figure2 – Quantitative profile of participants in the international rating system of UI GreenMetric[11]

Sumy State University is also an active and proactive implementer of the green campus concept. Thus, in 2021 this university took a second place among Ukrainian higher education institutions (Table 3).

Table 3 – Leading Ukrainian universities in the UI GreenMetric ranking in 2021[12]

University	Rating	Score					
		Infrastructure	Energy	Waste	Water use	Transportation	Education and research
Ukrainian National University of Forestry	1	1100	1050	1275	700	1275	1675
Sumy State University	**2**	**975**	**1025**	**1050**	**650**	**1225**	**1200**
The National University of Ostroh Academy	3	1000	1025	1050	550	1350	1125
Uman National University of Horticulture	4	700	1250	975	650	975	1025
Lviv Polytechnic National University	5	625	1075	825	450	950	1525

Currently, Sumy State University implements a number of green initiatives. The most important results of green strategy implementation can be observed in the areas of energy efficiency, waste management, organization of research in environmental economics.

CONCLUSIONS

Analyzing the world experience of creating eco-campuses at the international level, we can highlight the green initiatives of institutional, scientific, educational and social nature: the creation of institutional centers for sustainable development and communication; development of projects on greening of university life; development of syllabuses with the inclusion of sustainable development elements; conducting international pro-environmental actions; ecological book circulation, etc. The administration of the world's universities is aware of the urgency and need to join the global program Green Campuses, which significantly enhances the international image and promotes a positive business reputation. Sumy State University is also actively involved in green initiatives. Thus, in 2021 it took the 385th place in the authoritative ranking of UI GreenMetric among 956 universities in the world. Prospects for strengthening the position of SSU in the world rating system are quite high, as the university is an initiative implementer of green projects.

АНОТАЦІЯ

***Мареха І.С., Курбатова Т.О., Кириченко К.І., Лазненко Д.О., Чигрин О.Ю.* «Зелені кампуси» університетів світу.**

Метою статті є аналізсвітової практики реалізації програм «Green Campuses» у закладах вищої освіти та оцінка можливостей практичної імплементації принципів сталого розвитку в університетах України. При проведенні дослідження у статті було використано наступні методи: ретроспективного аналізу – при розгляді основних етапів еволюції концепції «зелених кампусів», системно-структурного аналізу – при обґрунтуванні та побудові п'ятиопорної структури еко-кампусу, порівняльного аналізу – під час репрезентації прикладів ефективної організації «зелених кампусів» у глобальному масштабі. У статті наголошується, що університети з усього світу просувають місію надання майбутнім фахівцям якісної освіти, яка сприятиме адекватному розвитку студентських здібностей на користь громади та держави. Тому цінності, які інкорпоруються тими чи іншими закладами вищої освіти, є істотним фактором, яким керуються абітурієнти при виборі місця навчання. У цьому контексті все більша чисельність університетів у глобальному масштабі почали звертати увагу на важливість включення чинника екологічності та ресурсоощадливості як невід'ємної складової своєї корпоративної культури і навіть архітектури. Метою цієї екологічної ініціативи є створити ідеологічне підґрунтя для студентів, які б жили екологічно сталими діями як щоденною практикою. Поряд з екологічними перевагами для людини та навколишнього середовища, «зелені кампуси» несуть економічні, соціальні та репутаційні переваги для вишів-послідовників. У статті авторами було виведено п'ятиопорну структуру «зелених кампусів», яка покладена в основу теоретико-концептуальних положень екологізації освітньої діяльності. Так, дана структура передбачає такі системні компоненти. як «зелене» адміністрування ЗВО, екологізацію освітньої та методичної діяльності, науково-інноваційну діяльність в області «зеленої економіки», екологічне виховання студентів та партнерство заради цілей сталого розвитку. У статті наведено світові приклади ефективної організації «зелених кампусів» з обґрунтуванням практичних результатів. Деталізовано та коротко охарактеризовано рейтингову систему UI GreenMetric, учасником якої став і Сумський державний університет, посівши друге місцезавдякипро-екологічній активності, яка носить систематичний та стратегічний характер.

Ключові слова: *«зелені кампуси», цілі сталого розвитку, «зелена» освіта, ресурсоефективність, раціональне природокористування, міжнародна рейтингова система, провідні виші*

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