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Valentyna Radkewych

ORCID: 0000-0002-9233-5718

THE ROLE OF VOCATIONAL EDUCATION IN TRAINING SKILLED PROFESIONALS FOR THE CIRCULAR ECONOMY

ROLA KSZTAŁCENIA ZAWODOWEGO W PRZYGOTOWANIU WYKWALIFIKOWANYCH SPECJALISTÓW DLA GOSPODARKI OBIEGU ZAMKNIĘTĘGO

РОЛЬ ПРОФЕСІЙНОЇ ОСВІТИ У ПІДГОТОВЦІ КВАЛІФІКОВАНИХ ФАХІВЦІВ ДЛЯ ЦИРКУЛЯРНОЇ ЕКОНОМІКИ

In the 21st century, due to the intensification of global environmental and resource crises, the strategic reorientation of economic systems based on the circular economy principles is particularly relevant. The dominance of the linear consumption model, grounded in the "take – use – dispose" principle, has led to the rapid depletion of natural resources, an increase in waste volume, and large-scale environmental pollution. In this context, the circular economy makes it possible to significantly reduce anthropogenic pressure on ecosystems by utilizing secondary raw materials, extending product life cycles, implementing resource-efficient technologies, and substantially decreasing the industrial carbon footprint (Ellen MacArthur Foundation, 2025). According to the International Energy Agency, approximately 45% of carbon emission reductions by 2050 can be achieved through the transformation of material production methods, transport, and waste management (International Energy Agency, 2020). This approach harmonizes with the Paris Climate Agreement, which stipulates restraining the global temperature increase to 1.5°C. At the same time, the circular economy is not limited solely to

environmental goals but shapes a new logic of economic development, focused on efficiency, innovation, and reduced dependence on primary resources (European Commission, 2020). After all, global demand for raw materials, especially critical materials, exceeds the pace of their renewal, which provokes instability in supply sources and an increase in geopolitical tension. The circular economy responds to this challenge based on strategies of eco-design, reuse, repair, and material recycling, thereby lowering dependence on raw material imports (World Economic Forum, 2023). Furthermore, digital technologies, such as blockchain and the Internet of Things, integrated into circular business models, ensure transparency and tracking of material flows, which enhances resource management efficiency (Geissdoerfer et al., 2017). Given this, the circular transformation of the economy is not only an ecological but also a geo-economic necessity.

Socio-economic aspects also determine the strategic significance of the circular economy. It creates prerequisites for the emergence of new jobs in the fields of green engineering, environmental consulting, waste logistics, and service maintenance. According to estimates by the International Labour Organization, the transition to a green economy, including the circular economy, will enable the creation of over 24 million new jobs worldwide by 2030 (International Labour Organization, 2018). This is particularly important in the context of increasing automation, which displaces traditional professions. Social innovations associated with circular approaches contribute to the formation of a new culture of consumption based on conscious choice, responsibility, and environmental ethics (Mont et al., 2020). The circular economy is also critically important for adapting governance systems to new challenges through the formation of regulatory frameworks, especially amid global competition. This ensures economic resilience by reducing dependence on resource price fluctuations, diversifying sources of income, and strengthening innovation potential. Analysis of practices in leading countries worldwide, including the Netherlands, Sweden, and Japan, indicates that circular strategies are being integrated into national development programs, stimulating the growth of small and medium-sized businesses (Kirchherr et al., 2018). Consequently, a new economic paradigm is being formed, in which economic growth is not associated with resource depletion but is based on their efficient use, innovation, and environmental responsibility.

In the context of the transition to a circular economy in Ukraine, a special role is assigned to the professional training of future specialists capable of implementing sustainable development principles in various economic sectors. Vocational Education and Training (VET), as a system focused on the practical preparation of qualified personnel, has the potential to become a key instrument

in forming competencies in eco-design, material reuse, recycling, and product repair, which are core elements of the new economic paradigm. Given this, the necessity of modernizing the content of VET, adapting educational programs to new economic realities, integrating sustainable production practices, and ensuring the training of specialists capable of working effectively under resource constraints is determined. In particular, the development of "green" competencies among students is important, which requires a review of curricula and teaching methodologies. Research results confirm the effectiveness of integrating circular economy principles into educational programs for preparing specialists for professional activities under conditions of sustainable development (Sysoiev, 2023).

To enhance the quality and attractiveness of VET in the context of the new economic paradigm, the initiatives of the European program EU4Skills, which foresee the creation of Centers of Professional Excellence, are important. These centers will facilitate the integration of circular economy principles into the educational process, ensuring the formation of sustainable development-oriented competencies in future specialists. These competencies encompass systems thinking, foresight, strategic planning, normative regulation, and interpersonal skills. Systems thinking, in particular, allows for the analysis of complex interconnections between social, environmental, and economic systems, which is critically important for understanding the impact of decisions at various levels. Foresight makes it possible to evaluate possible scenarios for the development of events to make informed decisions in the field of sustainable development. Normative regulation is aimed at forming values and goals that comply with the principles of sustainability. Strategic planning ensures the development and implementation of effective strategies for transitioning to the circular economy, as well as the formation of interpersonal skills in future specialists, which promotes effective communication and cooperation among stakeholders (Wiek et al., 2011). For example, in the field of product design oriented toward the circular economy, it is necessary to consider the principles of multiple use, restoration possibilities, and assessment of environmental impact throughout the entire product life cycle. This requires designers to be able to integrate ecological aspects into the product development and use process. These approaches contribute to reducing the negative environmental impact and increasing resource utilization efficiency (Moreno et al., 2021).

Given the above, the content of VET should be aimed at forming not only professional competencies in future specialists but also ethical values, particularly responsibility for the environment and society. Accordingly, the educational process in this area should be based on the integration of sustainable development

elements and social education in the context of daily professional activities. Indeed, the formation of such values as a careful attitude towards resources, respect for work, and cooperation in a team requires targeted pedagogical influence. This is facilitated by the development of state educational standards, based on a competency approach, which include ethical responsibility as a key characteristic of professional readiness (Ministry of Education and Science of Ukraine, 2021). The integration of ethical values into the professional training of specialists is based on introducing an interdisciplinary approach to content formation, which includes ecological and social components. For instance, the topic of sustainable development is actively introduced into training modules on labor protection, organization of production, and labor law. This allows students to realize the impact of professional activities on the environment and community well-being. According to UNESCO (2020), Education for Sustainable Development is critically important for preparing responsible citizens and workers capable of acting in the interests of future generations.

Effective assimilation of ethical values by VET students is facilitated by pedagogical methods focused on developing critical thinking, empathy, and responsibility. Furthermore, the modeling of professional situations and educational excursions to enterprises with high sustainability standards provide them with a realistic understanding of the social consequences of professional decisions. Accounting for the cultural context of integrating ethical values into the content of specialist training is important. In particular, understanding local traditions, norms, and values makes it possible to adapt educational programs so that they are relevant and acceptable to students. This positively affects the deeper assimilation of ethical principles and their application in professional activities. For example, considering local environmental problems in educational case studies makes learning more practical and important for students. The creation of a favorable educational environment that supports the development of ethical values is significant. This includes not only educational programs but also the general atmosphere in the VET institution, the relationship between students and teachers, and the social and environmental responsibility of the educational process participants. The formation of environmental responsibility in future specialists is also possible through the introduction of thematic modules that cover the fundamentals of eco-rational production, resource conservation, and safe waste management. Such modules are developed in accordance with the National Qualifications Framework and integrated into the VET content of various sectoral orientations, such as energy, construction, transport, agriculture, services, etc. Research results show that the implementation of eco-oriented approaches

to training specialists for the circular economy contributes to increasing their environmental awareness and readiness to act in accordance with sustainable development principles (CEDEFOP, 2023). An effective tool for implementing ethical practices is active cooperation with social partners. Employers, involved in the educational process, convey their expectations regarding student behavior, including in the ethical dimension. This creates a space for forming an understanding of the significance of work for society and a responsible attitude toward the production environment. Experts from the International Labour Organization emphasize the importance of involving business in educating socially responsible specialists through VET (ILO, 2021). Such a comprehensive approach contributes to the formation of students' holistic understanding of ethics and its importance in professional and personal life.

At the same time, adapting VET content to the requirements of the circular economy faces a number of barriers that can be classified as financial, institutional, and socio-cultural. These obstacles significantly complicate the integration of circular economy principles into the VET content. Financial barriers are among the most substantial. The costs of modernizing the infrastructure of VET institutions, purchasing equipment, and developing new educational programs often exceed the institutions' budget capabilities. Unlike VET institutions, the expenditures of companies on the professional training of their employees are higher and usually amount to no less than 5% of the wage fund. This indicates the need for significant investments in the development of VET to ensure the transition to the circular economy (Eurydice Ukraine, 2023). Institutional barriers manifest in the fragmentation of management structures and the lack of a unified strategy for VET development in the context of the circular economy. VET management in Ukraine is distributed between central executive bodies and local self-government. This complicates the coordination of efforts and the effective implementation of educational programs aimed at introducing circular economy principles (Eurydice Ukraine, n.d). Socio-cultural barriers indicate an insufficient level of awareness and motivation among students, pedagogical staff, and employers regarding the importance of the circular economy. Informational inertia, the lack of compelling examples, and insufficient staff qualifications are significant obstacles to adapting VET content to new requirements. These factors reduce the effectiveness of educational initiatives and slow down transformation processes.

In overcoming these barriers, it is important to consider progressive foreign experience, which demonstrates the effectiveness of integrating circular economy principles, implementing digital technologies, rethinking approaches

to assessment, and establishing partnerships in vocational education, among other things. In the Netherlands, for example, educational institutions collaborate with businesses and municipalities within initiatives focused on material reuse, waste reduction, and the development of green logistics. Students are engaged in real-world production projects where they study the product life cycle, assess the environmental impact, and propose strategies for its minimization. This approach contributes to the formation of ecological responsibility and the ability to make decisions in the context of the economic model's transformation among learners (CEDEFOP, 2021; European Commission, 2020). In Finnish educational institutions, significant attention is focused on interdisciplinarity and the practical application of circular economy principles in vocational training. Educational programs are implemented that cover topics such as eco-design, resource management, and sustainable business models. Digital tools for modeling product use cycles are actively integrated into the educational process, allowing students to understand the interrelationship between economic feasibility and environmental effectiveness. The effectiveness of such programs is confirmed by the high level of graduate employment in the green economy sectors (Ministry of Education and Culture of Finland, 2022; Finnish National Agency for Education, 2023). In Germany, the dual education system is adapting to the needs of the circular economy through the modernization of qualification standards and the updating of educational content. Within the framework of the "Berufsbildung für nachhaltige Entwicklung" program, partnerships have been established between educational institutions, industrial associations, and federal authorities, promoting the implementation of thematic modules on energy efficiency, waste management, and environmental auditing. Training is conducted not only in classrooms but also at enterprises, where students participate in the implementation of circular solutions in production. This increases the level of correspondence of vocational education to the real needs of the labor market (Bundesinstitut für Berufsbildung, 2021). Students in Slovenian educational institutions participate in the development and implementation of startups focused on upcycling and equipment repair, which contributes to the formation of entrepreneurial skills and an understanding of the importance of resource conservation. These examples demonstrate the effectiveness of a practice-oriented approach in training specialists for the circular economy (Lavtizar et al., 2021; Circular Change Slovenia, 2023). The experience of France in developing the vocational education ecosystem based on the implementation of "lycées des métiers verts" projects, focused on sustainable development and the circular economy, is of scientific interest. To this end, specialized platforms are created in educational institutions for mastering

skills related to green energy, biomaterials, and closed-loop production management. Industry experts are actively involved in the educational process, which guarantees the alignment of educational programs with modern challenges. This contributes to the formation of qualified specialists for the transformation of the economy in accordance with the principles of sustainable development (Ministère de l'Éducation nationale et de la Jeunesse, 2021). The experience of Spain also deserves attention, where the modernization of vocational education is taking place through the implementation of the national strategy "Plan de Modernización de la FP". Within this strategy, educational institutions implement educational programs aimed at forming competencies in environmental management, green engineering, and digital technologies for resource monitoring. Practical training is carried out in cooperation with enterprises that implement circular production models, particularly in agriculture, construction, and the textile industry. This approach facilitates the training of specialists capable of implementing innovative solutions in various economic sectors (Ministerio de Educación y Formación Profesional, 2021; Fundación Biodiversidad, 2023).

Based on the consideration of the best foreign practices, the key components for preparing future specialists to solve complex problems related to the circular economy principles, development of critical thinking, and creativity are practice-oriented learning and cooperation with employers. Specifically, the project method enables learners to apply theoretical knowledge in practice, developing the skills necessary for the effective use of resources and waste reduction. For example, in the construction sector, future specialists must be taught the principles of energy efficiency, the use of secondary materials, and waste management. The implementation of practice-oriented teaching methods also positively affects the development of collaboration and communication skills in learners, which are essential for effective work in interdisciplinary teams. This is especially relevant in the context of the circular economy, where solving environmental problems requires the joint efforts of specialists from various fields. The opportunity to see the results of their work and their impact on the environment stimulates learners toward active self-development. Furthermore, participation in such tasks allows them to develop entrepreneurial thinking and the ability to make independent decisions for successful professional activity within the circular economy. One of the main aspects of this process is the modernization of the material and technical base of vocational education institutions. This includes providing modern equipment that meets the requirements of sustainable production, implementing energy-efficient technologies, and waste and resource management systems. Collaboration between vocational education institutions

and enterprises is important for the creation of training and practical centers where learners can acquire practical skills in real production conditions. In the process of learning, learners become familiar with real production processes and labor market requirements, acquiring practical skills adapted to the needs of specific industries. The participation of enterprise representatives in the organization of the educational process also positively influences the updating of educational programs in accordance with modern technological and environmental requirements. The development of partnerships between state, private, and public structures is no less important. Such partnerships allow for financial support for the implementation of innovative educational projects.

In the context of crisis situations, such as the war in Ukraine, partnership plays an important role in ensuring the continuity of the educational process. Cooperation between state institutions and the private sector enables rapid response to challenges, providing access to resources, technologies, and expertise. For example, UNESCO (2025) initiatives are aimed at supporting educational systems in crisis conditions by involving private partners in the process of restoring the infrastructure of vocational education institutions and ensuring a safe educational environment. Cooperation with international organizations to attract investment in the modernization of vocational education in Ukraine and its integration into the European educational space also contributes to this. For example, the project "Public Private Partnership to Improved Professional Education" supported by the Swiss Agency for Development and Cooperation contributes to the updating of educational programs in accordance with international standards and the involvement of business in the specialist training process (Swisscontact, 2024). Such initiatives help ensure the quality of vocational education and its relevance to the labor market needs.

In the implementation of these tasks, the role of pedagogical staff is important; they must possess modern knowledge and skills in the field of sustainable development, environmental management, and innovative technologies. This requires the implementation of new professional development programs and the creation of conditions for their continuous professional growth, as well as the development and introduction of courses covering aspects of the circular economy, sustainable production, and waste management. For example, within the framework of the "Green Skills Ukraine" program, teachers from vocational education institutions are trained to teach topics related to green technologies and the circular economy (Swisscontact, 2024).

Digital technologies play an important role in increasing the effectiveness of vocational education in Ukraine, especially in the context of the circular economy.

They contribute to the development of necessary competencies in future specialists, providing interactive learning and access to relevant knowledge, when traditional teaching methods may be limited due to various factors, including military operations, etc. For instance, virtual simulations allow vocational education learners to practice their skills in a safe and controlled educational environment. This is especially crucial for training in fields where practical experience is critical, such as engineering, energy, and waste management. Moreover, virtual simulations enable the modeling of various scenarios, which helps learners develop critical thinking and decision-making skills in non-standard situations. They also facilitate the integration of circular economy principles into the educational process, as they provide for the study of effective methods of resource use and waste management without the need for physical intervention (European Training Foundation, 2020). The use of augmented reality allows for the modeling of production scenarios, providing learners with a safe environment for training, which contributes to reducing costs, improving the prevention of occupational risks, and enhancing decision-making processes. For example, in the woodworking and furniture manufacturing sector, digital technologies are used to create virtual laboratories where learners can practice designing and manufacturing products without health risks and with reduced material costs. Waste management in the circular economy also requires the implementation of innovative technologies, such as artificial intelligence and automation, to optimize the processes of waste collection, sorting, and processing. Given this, learners must master the skills of using digital tools for analyzing big data. This allows for the identification of opportunities to increase efficiency and reduce production losses. It is also important to develop competencies in the field of supply chain management, which involves planning reverse logistics and ensuring transparency at all stages of the product life cycle. These skills contribute to the creation of closed-loop resource use cycles and the reduction of negative environmental impact (Roland Berger, 2021).

An important tool for the digitalization of vocational education is online courses. They provide access to high-quality educational content regardless of the geographical location of the learners. This is especially relevant for Ukraine, where some regions have limited access to traditional educational resources. Online courses expand the opportunities for inclusive education, allowing people with special educational needs and from various social groups to receive education and enhance their professional qualifications. The content of online courses can cover a variety of topics, from the basics of the circular economy to specialized courses on waste management and sustainable production (European Training

Foundation, 2020). The integration of digital technologies into the content of vocational education positively affects the development of digital competencies in learners for working with information systems and using digital tools in solving professional tasks. This expands their opportunities for engagement in contextual assignments, contributes to the development of analytical skills and creative abilities, collaboration, and communication. At the same time, the integration of digital technologies into vocational education in Ukraine faces certain challenges. These include inadequate infrastructure, limited access to high-speed internet in some regions, and the insufficient level of digital literacy among pedagogical staff. To overcome these challenges, it is necessary to invest in infrastructure development, conduct training for teachers, and ensure access to modern digital resources for educators and vocational education learners. Moreover, it is important to develop and implement national strategies for the digitalization of education that take into account the specificity of vocational education and the needs of the labor market (European Training Foundation, 2020).

Conclusions

Thus, vocational education in Ukraine gains new significance in the context of the transition to the circular economy, which involves optimizing resource use, minimizing waste, and implementing modern production technologies. This transition requires the training of specialists capable of working in conditions of sustainable development, which, in turn, necessitates the modernization of educational programs to ensure the formation of competencies in future specialists necessary for working in the circular economy, such as resource management, ecological thinking, and the capacity for innovation. The successful implementation of the circular economy concept requires close cooperation between vocational education institutions, businesses, and state structures. Partnership is a key mechanism in this process, ensuring the adaptation of educational programs to the needs of the labor market and promoting the implementation of innovations. The involvement of the private sector in the learning process allows for equipping learners with the practical skills needed to work in a circular economy environment. An important aspect is also the implementation of a system for monitoring and evaluating the quality of vocational education based on tracking the effectiveness of educational programs and their compliance with labor market requirements. This contributes to the timely updating of educational programs and ensuring their relevance. The development of vocational education in Ukraine is facilitated by the implementation of European standards into the educational process and

ensuring access to modern educational resources through the implementation of programs such as EU4Skills and ReSkill UA, among others. Thus, vocational education in Ukraine plays a key role in training specialists for the circular economy. Its development requires a comprehensive approach that includes the modernization of educational programs, the development of partnerships, the implementation of a system for monitoring the quality of vocational education, and active international cooperation. These measures will contribute to the training of specialists capable of working effectively in the circular economy and its development in Ukraine (OECD, 2022).

Based on the foregoing, the key directions for professional training of specialists in vocational education institutions for the circular economy are: firstly, updating the content of educational programs considering sustainable development principles. This involves introducing thematic modules related to waste management, resource reuse, eco-design, and sustainable production, etc., adapted to the national context and labor market needs. For example, in European Union countries, the integration of such topics into the content of educational programs contributes to the formation of systemic thinking in students, which is necessary for performing professional tasks in a circular economy; secondly, developing partnerships between vocational education institutions and businesses. Cooperation with enterprises that implement circular economy principles allows learners to gain practical experience and an understanding of real production processes. For example, the EdUP project in Ukraine demonstrates the effectiveness of such cooperation, where business provides resources for the training and internships of future specialists, facilitating their preparation for work in conditions of sustainable development. Such interaction makes the modernization of the material and technical base of vocational education institutions possible; thirdly, integrating digital technologies into the educational process through the use of electronic platforms, virtual laboratories, and simulations ensures vocational education learners' access to relevant educational materials, and also enables them to gain practical skills in working with modern technologies used in the field of sustainable production. The experience of implementing such technologies in vocational education institutions in Ukraine confirms their effectiveness in creating a sustainable educational environment; fourthly, developing competencies in the field of sustainable development based on the formation of skills such as critical thinking, environmental awareness, the capacity for innovation, and adaptation to change. In Germany, for example, vocational education has long been oriented towards developing such competencies, which contributes to the training of specialists capable of working in conditions of sustainable development. Ukraine

also needs to develop strategies and methodologies for forming similar skills in vocational education learners; fifthly, ensuring financial support for vocational education institutions for implementing changes. This can include state funding, grants, as well as attracting funds from business based on partnership mechanisms. For example, a model has been successfully implemented in Switzerland where business invests in vocational education, receiving tax benefits and other incentives in return. Ukraine also needs to develop similar mechanisms to ensure sustainable financing of vocational education and increase the motivation level of employers to invest in the professional training of qualified specialists; sixthly, improving the qualifications of pedagogical staff through participation in trainings, seminars, and other forms of professional development with the aim of mastering the knowledge and skills necessary for implementing innovative teaching methods. For instance, the creation of a communication network for pedagogical staff will facilitate the exchange of experience and best educational practices.

In summary, the professional training of future specialists for the circular economy requires a comprehensive approach that includes updating educational programs, integrating digital technologies, and forming sustainable development competencies in learners. At the same time, the implementation of circular economy principles in the educational process of vocational education institutions requires financial support from the state, the development of a regulatory framework, and the creation of conditions for effective cooperation between vocational education institutions, business, public organizations, and international partners, etc.

ABSTRACT: The article is devoted to substantiating the strategic role of vocational education in Ukraine's transition to a circular economy. Against the backdrop of escalating global environmental and resource crises caused by the dominance of the linear consumption model, the circular economy is viewed as a necessary paradigm for sustainable development. It offers systemic solutions not only for achieving environmental sustainability through reduced anthropogenic pressure and a smaller carbon footprint but also for increasing economic competitiveness, stimulating innovation, and creating new jobs, which is particularly relevant for the country's post-war reconstruction.
The central argument of the article is that the successful implementation of circular models is impossible without training qualified personnel capable of thinking and acting according to new principles. In this context, the role of vocational education and training (VET) is analyzed as a key tool for forming a new generation of specialists. The main directions for modernizing the content

of education are revealed: the integration of "green" competencies, which include product lifecycle management, reverse logistics, resource efficiency, and eco-design, and the introduction of ethical values, particularly environmental responsibility. Such a transformation necessitates updating professional standards and actively involving teaching staff, for whom continuous professional development programs must be created.
Particular attention is paid to the challenges hindering the transformation of the educational process – financial, institutional, and socio-cultural barriers. To overcome them, progressive foreign experience (the Netherlands, Finland, Germany) is analyzed, and practice-oriented approaches are proposed. The key role of public-private partnership in modernizing the material and technical base and creating educational and practical centers is emphasized. The importance of implementing digital technologies (virtual simulations, online courses) to improve the quality and accessibility of vocational education, especially for students from temporarily occupied or affected territories, is highlighted. In conclusion, the article positions the modernization of vocational education as an integral component of Ukraine's green recovery strategy, which will ensure the training of specialists capable of building a sustainable, innovative, and competitive economy of the future.

KEYWORDS: circular economy, vocational education, sustainable development, content of education, green competencies, digital technologies, ethical values, labor market

STRESZCZENIE: Artykuł poświęcono uzasadnieniu strategicznej roli kształcenia zawodowego w przejściu Ukrainy do gospodarki obiegu zamkniętego (GOZ). W obliczu narastających globalnych kryzysów ekologicznych i zasobowych, spowodowanych dominacją liniowego modelu konsumpcji, GOZ jest postrzegana jako niezbędny paradygmat zrównoważonego rozwoju. Oferuje ona systemowe rozwiązania nie tylko dla osiągnięcia równowagi ekologicznej poprzez zmniejszenie presji antropogenicznej i redukcję śladu węglowego, ale także dla zwiększenia konkurencyjności gospodarczej, stymulowania innowacji i tworzenia nowych miejsc pracy, co jest szczególnie istotne w kontekście powojennej odbudowy kraju.
Centralnym argumentem artykułu jest to, że pomyślna implementacja modeli obiegu zamkniętego jest niemożliwa bez przygotowania wykwalifikowanych kadr, zdolnych do myślenia i działania według nowych zasad. W tym kontekście analizowana jest rola kształcenia i szkolenia zawodowego jako kluczowego narzędzia kształtowania nowej generacji specjalistów. Ujawniono główne kierunki modernizacji treści kształcenia: integrację kompetencji „zielonych", obejmujących zarządzanie cyklem życia produktu, logistykę zwrotną, efektywność zasobową i ekoprojektowanie, oraz wprowadzanie wartości etycznych, w szczególności odpowiedzialności za środowisko. Taka transformacja wymusza konieczność odnowienia standardów zawodowych oraz aktywnego zaangażowania kadry pedagogicznej, dla której należy tworzyć programy ustawicznego rozwoju zawodowego.
Szczególną uwagę poświęcono wyzwaniom utrudniającym transformację procesu edukacyjnego – barierom finansowym, instytucjonalnym i społeczno-kulturowym. W celu ich pokonania przeanalizowano postępowe doświadczenia zagraniczne (Holandia, Finlandia, Niemcy) i zaproponowano podejścia zorientowane na praktykę. Podkreślono kluczową rolę partnerstwa publiczno-prywatnego w modernizacji bazy materialno-technicznej i tworzeniu centrów szkoleniowo-praktycznych. Zaznaczono ważność wdrażania technologii cyfrowych (symulacje wirtualne, kursy online) dla podniesienia jakości i dostępności kształcenia zawodowego, zwłaszcza dla osób uczących się z terenów tymczasowo okupowanych lub dotkniętych działaniami wojennymi. Podsumowując, artykuł

pozycjonuje modernizację kształcenia zawodowego jako integralny element strategii zielonej odbudowy Ukrainy, który zapewni przygotowanie specjalistów zdolnych do budowania zrównoważonej, innowacyjnej i konkurencyjnej gospodarki przyszłości.

SŁOWA KLUCZOWE: gospodarka obiegu zamkniętego, kształcenie zawodowe, zrównoważony rozwój, treści kształcenia, kompetencje zielone, technologie cyfrowe, wartości etyczne, rynek pracy.

АНОТАЦІЯ: Статтю присвячено обґрунтуванню стратегічної ролі професійної освіти у переході України до циркулярної економіки. На тлі загострення глобальних екологічних і ресурсних криз, спричинених домінуванням лінійної моделі споживання, циркулярна економіка розглядається як необхідна парадигма сталого розвитку. Вона пропонує системні рішення не лише для досягнення екологічної стійкості через зменшення антропогенного тиску та скорочення вуглецевого сліду, але й для підвищення економічної конкурентоспроможності, стимулювання інновацій та створення нових робочих місць, що є особливо актуальним для повоєнної відбудови країни.
Центральним аргументом статті є те, що успішна імплементація циркулярних моделей неможлива без підготовки кваліфікованих кадрів, здатних мислити та діяти за новими принципами. У цьому контексті аналізується роль професійної освіти як ключового інструменту формування нової генерації фахівців. Розкрито основні напрями модернізації змісту освіти: інтеграція «зелених» компетентностей, що охоплюють управління життєвим циклом продукції, зворотну логістику, ресурсоефективність та екодизайн, і впровадження етичних цінностей, зокрема відповідальності за довкілля. Така трансформація зумовлює необхідність оновлення професійних стандартів та активного залучення педагогічних працівників, для яких необхідно створювати програми безперервного професійного розвитку. Особливу увагу приділено викликам, що стоять на заваді трансформації освітнього процесу, – фінансовим, інституційним та соціально-культурним бар›єрам. Для їх подолання проаналізовано прогресивний зарубіжний досвід (Нідерланди, Фінляндія, Німеччина) та запропоновано практико-орієнтовані підходи. Підкреслюється ключова роль державно-приватного партнерства у модернізації матеріально-технічної бази та створенні навчально-практичних центрів. Наголошено на важливості впровадження цифрових технологій (віртуальні симуляції, онлайн-курси) для підвищення якості та доступності професійної освіти, особливо для здобувачів із тимчасово окупованих чи постраждалих територій. У підсумку, стаття позиціонує модернізацію професійної освіти як невід›ємний компонент стратегії зеленого відновлення України, що забезпечить підготовку фахівців, здатних розбудовувати стійку, інноваційну та конкурентоспроможну економіку майбутнього.

КЛЮЧОВІ СЛОВА: циркулярна економіка, професійна освіта, сталий розвиток, зміст освіти, зелені компетентності, цифрові технології, етичні цінності, ринок праці.

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