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DUAL EDUCATION IN THE CONSTRUCTION SECTOR OF UKRAINE: A MANAGEMENT MODEL AND IMPLEMENTATION PROSPECTS IN THE CONTEXT OF POST-WAR RECOVERY

Introduction. The construction sector of Ukraine is currently undergoing profound structural transformation caused by both long-standing systemic challenges and the consequences of the full-scale war. One of the key threats to the sustainable development of the sector is the acute shortage of qualified personnel, particularly skilled workers and engineering and technical specialists. The decline in the working-age population, labour migration, the decreasing prestige of construction professions, as well as the mismatch between educational programmes and the actual needs of enterprises have led to a weakening of the human capital of construction companies.

Post-war reconstruction significantly exacerbates this problem. Large-scale programmes for the reconstruction of housing stock, transport, industrial and social infrastructure generate increased demand not only for the quantity of labour but also for qualitatively new competencies. The modern construction sector requires specialists capable of working with BIM technologies, applying principles of energy-efficient and sustainable construction, managing complex projects, using innovative materials, and complying with international standards of quality and safety. Under such conditions, traditional approaches to workforce training prove to be insufficiently effective.

The problem lies in the fact that the classical model of vocational and higher education in the construction field is primarily oriented toward theoretical training and a limited amount of practical experience. As a result, graduates lack the practical skills required for real production environments, while employers are forced to invest significant resources in additional training and adaptation. This reduces labour productivity, increases costs for construction companies, and negatively affects the pace and quality of project implementation, which is particularly critical during the post-war recovery period.

In this context, the search for effective mechanisms to integrate the education system with the real sector of the construction industry becomes increasingly relevant. One such mechanism is dual education, which combines theoretical learning in educational institutions with systematic practical training directly at enterprises. The dual model enables the training of specialists oriented

toward specific production processes, technologies, and managerial standards that correspond to the real needs of construction businesses.

The connection between the researched issue and previous scientific studies lies in the fact that both domestic and foreign scholars have extensively examined general issues of vocational education development, workforce training for industry and services, as well as the experience of implementing dual education in certain European Union countries. However, most existing studies focus on educational aspects of the dual model, its regulatory framework, or its social effects, while the specific features of the construction sector and the interests of construction companies as key stakeholders remain insufficiently explored. Current research does not fully account for the peculiarities of construction production, its project-oriented nature, high occupational safety requirements, technological complexity, and the need for rapid updating of workforce competencies. This necessitates further research aimed at substantiating dual education specifically as a tool for workforce provision and for improving the operational efficiency of construction companies in the context of Ukraine's post-war recovery.

Analysis of recent research and publications.

The issue of dual education has been actively studied in recent years in both domestic and international academic discourse, driven by the growing need to integrate the education system with the real sector of the economy. In contemporary publications, dual education is considered not only as an educational innovation but also as an institutional mechanism for human capital formation and for enhancing the competitiveness of enterprises.

A significant body of research focuses on analysing models for the implementation of dual vocational education and training in European Union countries. In particular, L. Martínez-Izquierdo and M. Torres Sánchez analyse dual VET as a result of educational policy transfer under conditions of decentralised governance in Spain [21]. The authors emphasise that the effectiveness of the dual model largely depends on the involvement of regional authorities and the active participation of employers. A similar institutional approach is developed in



the studies by C. Fernández-Salineró and co-authors [18], which concentrate on quality factors of dual education, including the training of workplace mentors, the organisation of cooperation between educational institutions and enterprises, and compliance with European quality assurance standards (EQAVET).

An important contribution to the development of this research field is made by studies examining the impact of labour market dynamics and migration processes on the sustainability of dual systems. In the work by J. Arnholtz and S. Østhus [15], it is demonstrated that the employment of migrant labour in sectors such as construction may reduce companies' incentives to invest in long-term dual training schemes. These findings are particularly relevant for the construction industry, where workforce shortages are often addressed through short-term solutions that do not support the strategic reproduction of qualifications.

A theoretical generalisation of the role of dual education as a mechanism for human capital development is proposed in the work by E. Vanderhoven et al. [25], which highlights the combination of economic and social effects of dual VET. The authors argue that dual education ensures not only a rapid transition of young people into the labour market but also the long-term development of professional competencies, which is critically important for industries characterised by high requirements for quality and occupational safety.

A separate group of studies addresses dual education within the higher education system. In particular, O. Shykina [10] considers dual education as a factor in the transformation of modern higher education, emphasising its role in developing applied competencies and increasing graduates' adaptability to employers' needs. A similar perspective is presented in the work by S. Amelina and R. Tarasenko [1], which examines the experience of German higher education institutions, where the dual form of education is regarded as an established instrument for training specialists for technically complex fields, including engineering and construction.

In the Ukrainian academic discourse, issues of dual education are analysed with regard to national challenges and the conditions of wartime. In particular, the study by O. Didenko [16] reveals the advantages and barriers to the development of dual vocational education in Ukraine, emphasising problems of institutional readiness, cooperation with business, and workforce provision for enterprises. These approaches are complemented by sectoral studies in which dual education is considered as a tool for the integrative development of business structures (for example, in the work by O. Shykina and O. Kuznetsova [9]), which allows the extrapolation of the obtained findings to the construction sector. A. O. Arterchuk, O. B. Mnykh and U. Ya. Sadova [2] consider dual education not only as an educational innovation but also as a strategic socio-economic instrument capable of ensuring the recovery

and development of human capital in accordance with labour market needs.

Special attention in contemporary research is given to the sectoral specificity of implementing dual education, particularly in technically complex sectors of the economy. Thus, in studies devoted to the experience of German higher education institutions, the dual form of education is regarded as an established instrument for training specialists for engineering and manufacturing fields, including construction, ensuring a close connection between theoretical training and real production processes and quality standards [17, 22].

This approach is further developed in domestic studies focused directly on the construction industry. In particular, O. Holyshev [3] substantiates the dual form of education as a prerequisite for effective vocational training of construction workers, emphasising its capacity to reduce the gap between the educational process and labour market requirements, enhance graduates' practical competencies, and shorten their adaptation period at enterprises. The author also highlights the importance of systematic involvement of construction companies in workforce training, notably through the organisation of paid work-based learning and mentoring, which correlates with European models of dual education and is especially relevant in the context of Ukraine's post-war recovery. Similar provisions are developed in the collective monograph of the Institute of Vocational Education of the National Academy of Educational Sciences of Ukraine, edited by N. V. Kulalaieva [6], which summarises the results of applied research on implementing elements of dual education in the vocational training of future skilled workers in the construction sector. In this monograph, dual education is interpreted as a systemic model based on social partnership between educational institutions and enterprises, providing a methodological foundation for integrating dual training into workforce provision practices of construction companies.

Summarising the results of the reviewed studies, it can be stated that contemporary academic literature sufficiently covers the institutional, educational, and socio-economic aspects of dual education. At the same time, sector-specific features of its application in the construction industry, as well as the significance of dual education from the perspective of construction companies as key stakeholders, remain insufficiently explored. This determines the need for further research aimed at substantiating dual education as a managerial model for workforce provision and improving the efficiency of construction enterprises in the context of Ukraine's post-war recovery.

The purpose of the article is to provide a theoretical and analytical substantiation of the feasibility of implementing dual education in the construction sector of Ukraine as a model for overcoming workforce shortages and ensuring effective professional training in the context of post-war recovery. The study focuses on analysing the advantages and limitations of the dual education

model from the perspective of construction companies as key employers, as well as on summarising European experience in applying dual education in technically complex industries. Particular attention is paid to identifying directions for adapting dual education to the needs of modern construction production, taking into account technological, organisational, and managerial transformations of the sector.

Presentation of the main research material. The essence of the dual model lies in the integration of theoretical education delivered by educational institutions with systematic practical training at enterprises, implemented through a specific organisational and legal framework. Within this system, students acquire knowledge in classrooms and laboratories while simultaneously undergoing long-term practical training in real production environments, which usually includes paid work directly at the workplace in accordance with the curriculum and employer requirements. This approach ensures not merely an alternation of separate theoretical and practical modules, but a continuous combination of learning and work throughout the entire period of professional training, in which the employer acts as one of the co-executors of the educational process [19].

In European dual education systems, the proportion of time students spend in educational institutions and at enterprises typically ranges from approximately 30–50% devoted to theoretical instruction and 50–70% to practical training or employment. For example, in the classical German model, the share of practical training at enterprises may reach up to 70% of the total training time, while theoretical education accounts for about 30% [23]. Such a distribution is adapted to specific sectors and qualification levels, ensuring deep immersion of learners in production processes and the development of professional competencies that meet the requirements of the modern labour market.

The outcome of implementing the dual model is a graduate who possesses not only a certificate of completion but also real professional experience, verified practical skills, and readiness to perform job-related duties from the first day of employment. Such graduates adapt significantly better to the production environment and demonstrate a higher likelihood of employment during the first months after graduation compared to traditional education models, where the practical component is limited to short-term internships or isolated training placements [20].

For construction companies, dual education primarily functions as an instrument of strategic workforce provision, enabling them to reduce dependence on an unstable labour market and external sources of labour. The involvement of students in production processes already at the training stage facilitates the formation of a workforce reserve adapted to specific technologies, quality standards, and the organisational culture of the enterprise. As a result, companies obtain employees who do not require a prolonged adaptation period, which is particularly important in the context of post-war reconstruction, when project implementation timelines are critical and workforce risks are substantial.

An important advantage of the dual model for the construction business is the reduction of costs related to staff training and retraining. Under the traditional model, employers are forced to invest significant resources in internal training of new employees, correction of errors caused by insufficient practical skills, and mitigation of staff turnover. In contrast, dual education enables the gradual development of professional competencies under real construction production conditions, reducing defect rates, accident risks, and violations of occupational safety requirements. For a technically complex and high-risk industry such as construction, this has not only economic but also social significance.

Moreover, dual education creates prerequisites for enhancing the innovative capacity of construction companies. The involvement of students and trainees in production processes facilitates the faster dissemination of modern technologies, including BIM modelling, digital project management, and energy-efficient and environmentally friendly solutions. Combined with mentoring provided by experienced employees, this contributes to the formation of a continuous learning environment within enterprises and strengthens their competitive position. Thus, for construction companies, dual education is not only a mechanism for addressing workforce shortages but also an element of a modern managerial model oriented toward long-term development in the context of Ukraine's post-war recovery.

Despite its potential advantages, the large-scale implementation of dual education in Ukraine, particularly in the construction sector, faces a number of significant barriers that limit its effectiveness and scalability. First of all, these include institutional and regulatory challenges. Analyses of the problems associated with implementing dual education in Ukraine indicate a low level of legislative and organisational maturity, which results in fragmented responsibility among educational institutions, employers, and public authorities, as well as a lack of clear incentives and guarantees for labour market actors [5]. Similar conclusions regarding the complexity of transferring the «German» model across borders are confirmed by international reviews: even in OECD countries, the success of dual programmes largely depends on social, cultural, and institutional contexts, and specific practices cannot always be easily transferred to other national education and labour systems [24]. Legal barriers are closely related to defining the status of dual education participants and the conditions of their legal protection. As highlighted in studies on legal aspects, issues related to labour rights, insurance, occupational safety, and remuneration of participants in dual programmes remain insufficiently regulated, which is particularly critical for the construction sector with its heightened safety and injury risks [5].

The second key limitation is the lack of resources and internal training capacity within enterprises. Construction companies often do not have a sufficient number of qualified mentors, systems for managing practical training, or their own structured training programmes, which negatively affects the quality of the practical

component of dual programmes. Comparative studies of dual education models in the EU emphasise the crucial role of professional associations and social partnerships in ensuring the quality of work-based learning an element that remains underdeveloped in Ukraine compared to countries such as Germany or Austria [24].

The third limitation concerns the mismatch between educational programmes and labour market needs. Domestic studies indicate that existing curricula often fail to reflect current technological requirements, including BIM technologies, digital construction processes, and energy-efficient methods that dominate the practices of leading construction companies in the EU [4]. As a result, learners effectively find themselves between two systems – «academic» and «practical» – without synchronised updating of training modules, which exacerbates skills gaps.

Another constraining factor is economic uncertainty and the project-based nature of construction activity in Ukraine. Due to fluctuations in construction volumes, dependence on public and donor funding, and unpredictable project implementation timelines, enterprises are often reluctant to undertake long-term commitments to workforce training in the form of dual students. Such budgetary and market volatility complicates planning investments in training and the development of internal HR infrastructures.

Finally, socio-cultural barriers also play a significant role. Despite successful international examples, there is still a degree of mistrust toward dual education models among Ukrainian employers and learners, as well as persistent stereotypes regarding the lower prestige of vocational education compared to traditional higher education. Such cultural attitudes create additional obstacles to the formation of effective partnerships between business and the education system.

All the identified constraints are interrelated and not only complicate the full-scale implementation of dual programmes in the construction sector but also require comprehensive policy and managerial solutions at the levels of public governance, corporate management, and educational institutions to achieve a systemic effect. International experience, particularly that of Germany and other EU countries, demonstrates that the effectiveness of the dual model is ensured not by isolated measures but by a stable architecture of social partnership among the state, business, and educational institutions.

The first priority direction is strengthening the institutional role of construction companies as full-fledged participants in the educational process. This involves the establishment of mentoring systems within enterprises, the development of internal standards for practical training, and the formalisation of employers' responsibility for the quality of professional competencies acquired by learners. EU practices show that the involvement of sectoral associations and professional organisations in coordinating dual programmes helps reduce the burden on individual companies and ensures the sustainability of workforce training.

The second important direction is the improvement of the regulatory and organisational framework for dual education, taking into account the specific characteristics of the construction sector. This includes clear regulation of the status of dual education participants, conditions of remuneration, insurance coverage, and occupational safety during work-based training. For an industry characterised by elevated production risks, these issues are of fundamental importance and directly affect employers' willingness to invest in workforce training. Ukrainian studies confirm that reducing legal uncertainty is a key prerequisite for more active business participation in dual education programmes.

The third direction of development involves synchronising educational programmes with technological transformations in construction production. Dual education should be oriented not only toward basic vocational skills but also toward the formation of competencies in BIM modelling, digital project management, and energy-efficient and sustainable construction. Such modernisation is possible only with the continuous involvement of construction companies in the design and updating of curricula, which corresponds to the European practice of sector-oriented dual training.

Particular attention should be paid to economic incentives for employers, including tax benefits, co-financing of mentoring programmes, and compensation for part of the costs associated with training learners. In the context of a post-war economy, such incentives may become a decisive factor in encouraging construction companies to participate in long-term workforce training programmes, reducing the perception of dual education as a high-risk investment.

Thus, the development of dual education in Ukraine's construction sector should be based on a combination of managerial, regulatory, and economic instruments aimed at reducing workforce risks and improving the operational efficiency of construction companies. In the context of post-war recovery, dual education can be viewed not merely as an educational format but as an element of a modern human capital management model that ensures the sustainable development of the sector by addressing workforce shortages, reducing operational risks, and improving the effectiveness of construction project implementation.

The proposed managerial model is based on the following principles: **integrated approach**, which combines personnel, production, and educational policies of the company; **project orientation**, involving workforce training tailored to specific types of construction projects; **shared responsibility**, implying a distribution of roles among the company, the educational institution, and the learner; **economic feasibility**, focusing on cost reduction and productivity growth; and **adaptability**, enabling rapid updating of competencies in response to technological changes.

The functional structure of the model is presented in Figure.

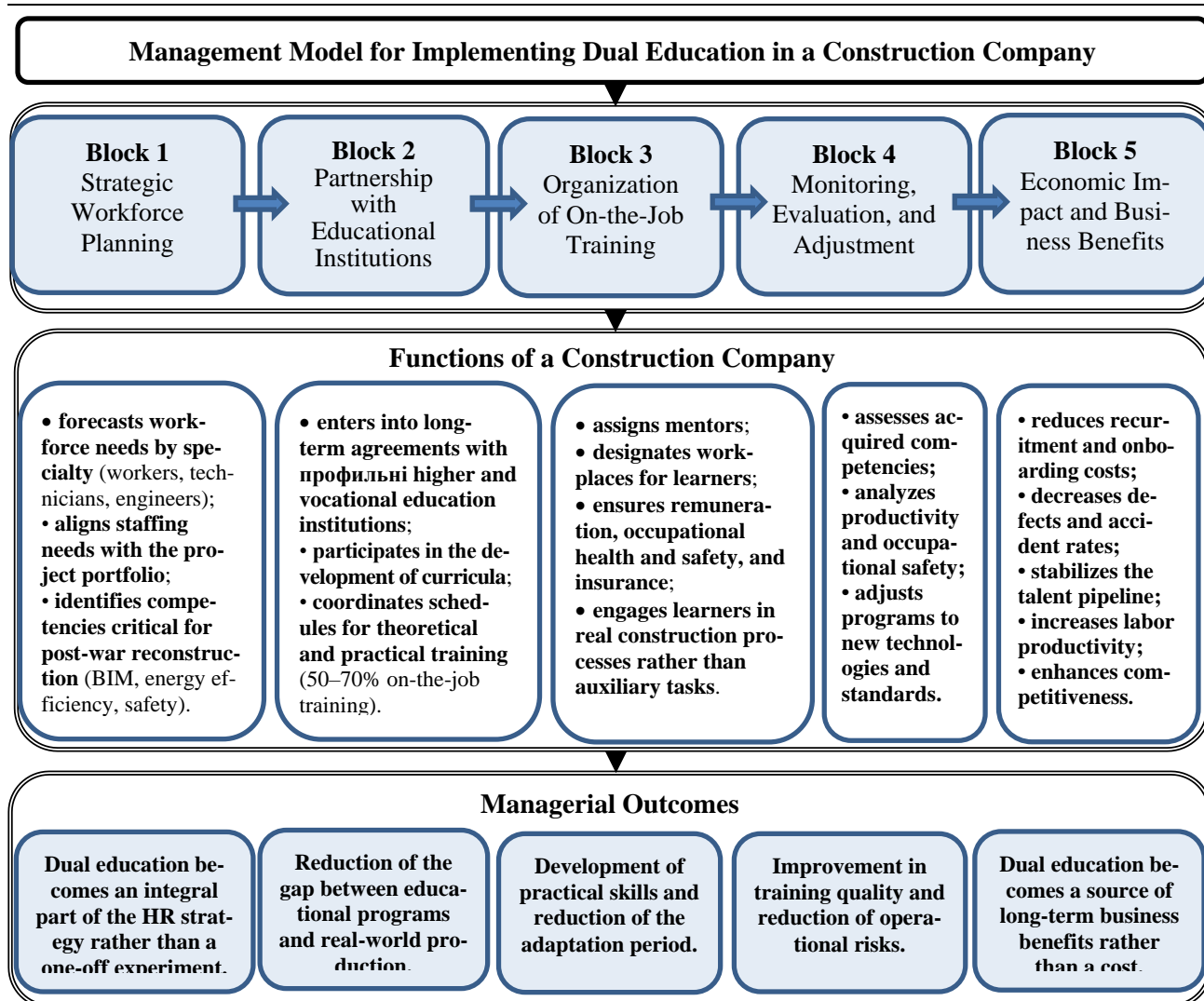


Figure. Management Model for Implementing Dual Education in a Construction Company

Source: compiled by the author

The management model schematically presented in Fig. 1 consists of five logically structured management blocks that integrate dual education into the enterprise's human capital management system. At the stage of strategic workforce planning, construction companies identify their staffing needs in accordance with the portfolio of construction projects and the requirements of post-war recovery, thereby forming demand for specific professional competencies. Within the framework of partnerships with educational institutions, construction companies participate in coordinating educational programs and dual training schedules, which makes it possible to align theoretical instruction with real production processes. The managerial outcome of these blocks is the formation of a targeted talent pool oriented toward the needs of a specific enterprise. The central element of the model is the organization of on-the-job training at the enterprise, which involves engaging learners in real construction processes, providing mentoring by experienced employees, and ensuring compliance with occupational safety requirements. Subsequent monitoring and evaluation of dual training outcomes enable compa-

nies to adjust training content, enhance the level of practical competencies, and reduce operational risks. The overall managerial outcome of implementing the model lies in reducing personnel adaptation costs, mitigating labor shortages, increasing labor productivity, and strengthening the competitiveness of construction companies in the context of Ukraine's post-war recovery.

Conclusions. The conducted analysis has shown that traditional workforce training models do not fully meet the current challenges of the construction industry, which is characterized by high technological complexity, increased occupational safety requirements, and an acute shortage of skilled workers and engineering and technical personnel. In this context, dual education creates opportunities to bridge the gap between the education system and the real needs of construction production.

A synthesis of European experience and domestic academic research made it possible to identify the advantages of the dual model for construction companies, including a shorter personnel adaptation period, reduced costs of initial training, the formation of a stable talent pool, and increased labor productivity. At the same time,

it was established that the implementation of dual education in Ukraine is constrained by a set of institutional, regulatory, organizational, and economic barriers that require a systematic approach to overcoming them, taking into account the sector-specific characteristics of the construction industry.

The outcome of the study is the development of a management model for implementing dual education in construction companies, which integrates dual training into the enterprise's human capital management system. The proposed model is based on the sequential implementation of management blocks and is oriented toward achieving specific managerial outcomes for business. This makes it possible to consider dual education not as a standalone educational initiative, but as an element of modern managerial policy in construction companies.

The management model integrates dual education into the construction company management system and ensures the mitigation of labor shortages, alignment of workforce training with real production needs, and increased efficiency of project implementation during the post-war recovery period. The model can be adapted for companies of different sizes and used as a basis for developing sector-wide dual training programs in Ukraine's construction sector.

The practical significance of the obtained results lies in the possibility of applying the proposed model in the development of HR strategies of construction enterprises, in designing sectoral dual training programs, and in implementing state and corporate post-war recovery projects. Further research should focus on the empirical testing of the model in construction companies of various scales and on evaluating its economic effectiveness.

LITERATURE

1. Амеліна С., Тарасенко Р. Дуальна форма навчання: досвід німецьких закладів вищої освіти. *Humanitarian studios: pedagogics, psychology, philosophy*. 2024. № 15 (2). С. 8–14. [https://doi.org/10.31548/hspedagog15\(2\).2024.8-14](https://doi.org/10.31548/hspedagog15(2).2024.8-14)
2. Артерчук А., Мних О., Садова У. Дуальна освіта та повоєнне відновлення України: чинники, моделі, європейський досвід. *Трансформаційна економіка*. 2024. № 3 (08). С. 83–88. <https://doi.org/10.32782/2786-8141/2024-8-12>
3. Голишев О. Дуальна форма навчання як умова ефективної професійної освіти працівників будівельного профілю. *Науковий вісник Вінницької академії безперервної освіти. Серія «Педагогіка. Психологія»*. 2025. № 7. С. 27–33. <https://doi.org/10.32782/academ-ped.psyh-2025-1.04>
4. Кучер О. Міжнародний досвід дуальної освіти та виклики її адаптації в Україні. *Alfred Nobel university journal of pedagogy and psychology*. 2023. № 2(26). С. 70–82. <https://doi.org/10.32342/2522-4115-2023-2-26-8>
5. Магомедова А. М., Погорелова О. С. Дуальна освіта в Україні: від правого забезпечення до проблем реалізації. *Економіка. Фінанси. Право*. 2021. № 10/1. С. 39–44. [https://doi.org/10.37634/efp.2021.10\(1\).8](https://doi.org/10.37634/efp.2021.10(1).8)
6. Методичні засади впровадження елементів дуальної форми навчання в професійну підготовку майбутніх кваліфікованих робітників будівельної, машинобудівної галузей, сфери обслуговування та громадського харчування: монографія / за наук. ред. Н. В. Кулалаєва). Київ: Інститут професійної освіти НАПН України, 2023. 118 с. URL: <https://conference.ivet.edu.ua/index.php/1/en/issue/view/11/10> (дата звернення 01.11.2025).
7. Новицька О. В. Інструменти стимулювання малого та середнього бізнесу в контексті регіонального розвитку. *Вісник ЧДТУ: зб. наук. праць Черкаського державного технологічного університету. Серія: Економічні науки*. 2015. № 39. Ч. II. С. 143–149. <https://doi.org/10.24025/2306-4420.2.39.2015.84489>
8. Новицька О. В. Особливості підтримки малого та середнього бізнесу в системі сучасного регіонального менеджменту. *Вісник ЧДТУ: зб. наук. праць Черкаського державного технологічного університету. Серія: Економічні науки*. 2014. № 37. Ч. II. С. 162–169.
9. Шикіна О., Кузнецова О. Дуальна освіта як інструмент інтеграційного розвитку готельних мереж. *Економіка та суспільство*. 2024. Вип. 60. <https://doi.org/10.32782/2524-0072/2024-60-27>
10. Шикіна О. В. Дуальна освіта як чинник трансформації вищої освіти в сучасних умовах. *Бізнес-навігатор*. 2025. Вип. 3 (80). С. 594–598. <https://doi.org/10.32782/business-navigator.80-100>
11. Якушева О., Павловська А. Еволюція теорії конвергенції в контексті інтеграції соціально-економічної системи регіонів. *Збірник Черкаського державного технологічного університету. Серія: Економічні науки*. 2022. № 64. С. 14–26. <https://doi.org/10.24025/2306-4420.64.2022.255806>
12. Якушев О. Світовий досвід розвитку кластерів: можливості адаптації в Україні. *Збірник наукових праць Черкаського державного технологічного університету. Серія: Економічні науки*. 2014. № 1 (38). С. 167–173. (дата звернення: 09.11.2025).
13. Якушев О. В., Якушева О. В. Управління бізнес-процесами регіону на засадах впровадження інноваційно-освітніх кластерів. *Соціально-економічний розвиток регіонів в контексті міжнародної інтеграції*. 2018. № 28 (17). С. 65–70.
14. Якушев О. В., Білан Є. В. Особливості управління діяльністю будівельних підприємств в умовах постконфліктної економіки. *Економіка і організація управління*. 2024. № 2. С. 134–142. <https://doi.org/10.31558/2307-2318.2024.2.12>
15. Якушев О. В. Розробка дорожньої карти активізації розвитку підприємств ІТ сфери в регіонах України. *Економіка і організація управління*. 2023. №1(49). С. 131–142. <https://doi.org/10.31558/2307-2318.2023.1.13>
16. Arnholtz J., Østhus S. Is labour migration disrupting dual vocational education and training systems? *European Journal of Industrial Relations*. 2024. Vol. 30. Iss. 3. P. 245–263. <https://doi.org/10.1177/09596801231226244>
17. Didenko O. Development of dual (vocational) education in Ukraine before and during the full-scale invasion of the russian federation in Ukraine. *Social Work and Education*. 2023. No. 10 (3). P. 348–360. <https://doi.org/10.25128/2520-6230.23.3.8>
18. Euler D. Germany's dual vocational training system: A model for other countries? Gütersloh: Bertelsmann Stiftung, 2013. URL: https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/GP_Germanys_dual_vocational_training_system.pdf (дата звернення 01.11.2025).
19. Fernández-Salinerо C., González-Fernández R., Arnaiz-Sánchez P. Comparison of dual VET models in Spain: Analysing quality factors. *Education Sciences*. 2024. Vol. 14. Iss. 7. Art. 779. <https://doi.org/10.3390/educsci14070779>
20. Karakai A. Workforce for reconstruction and dual education: How to engage business in training students. *VoxUkraine*. 2025. URL: <https://voxukraine.org/en/workforce-for-reconstruction-and-dual-education-how-to-engage-business-in-training-students> (дата звернення: 10.11.2025).

21. Learning and work: The benefits of work-based learning. Cedefop (European Centre for the Development of Vocational Training). Luxembourg, 2021. URL: https://www.cedefop.europa.eu/files/data_insight_work_experience.pdf (дата звернення: 10.11.2025).
22. Martínez-Izquierdo L., Torres Sánchez M. The adoption of dual vocational education and training in Spain: Analysis of decentralised decision-making in educational policy transfer. *Research in Comparative and International Education*. 2024. Vol. 19. Iss. 4. P. 479-502. <https://doi.org/10.1177/17454999241280922>
23. Mordhorst L., Jenert T. Curricular integration of academic and vocational education: a theory-based empirical typology of dual study programmes in Germany. *High Educ.* 2022. Vol. 85. P. 1257–1279. <https://doi.org/10.1007/s10734-022-00889-7>
24. The German dual VET system in the construction sector. Federal Institute for Vocational Education and Training. Bonn: UNESCO-UNEVOC, 2022. URL: https://unevoc.unesco.org/up/BIBB_KristinaSchaefer_German-dual-VET-construction.pdf (дата звернення: 05.11.2025).
25. Valiente O., Scandurra R. Challenges to the Implementation of Dual Apprenticeships in OECD Countries: A Literature Review / M. Pilz (Ed.). *Vocational Education and Training in Times of Economic Crisis*. Springer, 2017. P. 41–57 https://doi.org/10.1007/978-3-319-47856-2_3
26. Vanderhoven E., Fontdevila C., Langthaler M., Valiente O., Hermann R., Marković J., Calderón E. Realising the human development promise in dual VET. *Compare: A Journal of Comparative and International Education*. 2025. Vol. 55. Iss. 3. P. 496–511. <https://doi.org/10.1080/03057925.2024.2309240>
27. Yakushev O., Zachosova N., Zhurba I., Zubarieva H., Svishchenko H. Personnel security management of enterprise as a component of social protection and social stability in society. *Collection of Scientific Papers of Cherkasy State Technological University. Series: Economic Sciences*. 2022. No. 65. P. 4–15. <https://doi.org/10.24025/2306-4420.65.2022.262869>
28. Гуцалюк О. М. Проблеми використання управлінських технологій промисловими підприємствами України. *Матеріали Міжнар. наук.-практ. конф. «Пріоритети розвитку підприємств у XXI столітті»* (м. Кіровоград, 21-22 квіт. 2011 р.). Кіровоград: КОД, 2011. Ч. I. С. 145-146.
29. Гуцалюк О. М., Ремзіна Н. А. Методичні основи формування єдиного наскрізного тарифу мультимодальних перевезень. *Центральноукраїнський науковий вісник. Економічні науки*. 2020. Вип. 4 (37). С. 169-176. [https://doi.org/10.32515/2663-1636.2020.4\(37\).169-176](https://doi.org/10.32515/2663-1636.2020.4(37).169-176)
30. Гуцалюк О. М., Обнявко Т. С. Напрямки економіко-екологічної трансформації підприємств оборонно-промислового комплексу України. *Центральноукраїнський науковий вісник. Економічні науки*. 2021. Вип. 6 (39). С. 211-219. [https://doi.org/10.32515/2663-1636.2021.6\(39\).211-219](https://doi.org/10.32515/2663-1636.2021.6(39).211-219)
31. Гуцалюк О. М., Бондар Ю. А. Процеси цифровізації України на шляху до ЄС. *Європейський союз і Україна: пересторія, історія, сучасність*: тези Міжнар. наук. конф. (м. Миколаїв, 16 червня 2023 р.). Миколаїв: Чорноморський національний університет імені Петра Могили, 2023. С. 27-30.
32. Hutsaliuk O., Mankuta Ya., Yakusheva O. Adaptive models of management of innovative project activities of educational institutions on the basis of economic interaction and competitiveness. *Вісник Черкаського національного університету імені Богдана Хмельницького. Серія «Економічні науки»*. 2024. Vol. 28. № 1-2. P. 23-33. <https://doi.org/10.31651/2076-5843-2024-1-2-22-31>
33. Бондар Ю. А., Легінькова Н. І Формування механізму інноваційного розвитку економіки України. *Innovative Approaches to Ensuring the Quality of Education, Scientific Research and Technological Processes*. Publishing House of University of Technology, Katowice, Poland, 2021. С. 164-172. URL: <http://www.wydawnictwo.wst.pl/uploads/files/3ae54f97de8a1480cfb229660e616f25.pdf> (дата звернення 01.11.2025).
34. Бондар Ю. А., Письменна М. С. Вплив соціальних комунікацій на ефективність адміністративного менеджменту. *Міжнародні відносини: теоретико-практичні аспекти*. 2023. № 12. С. 63-78. <https://doi.org/10.31866/2616-745X.12.2023.292394>
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REFERENCES

1. Amelina, S., & Tarasenko, R. (2024). Dual form of education: the experience of german higher education institutions. *Humanitarian studios: pedagogics, psychology, philosophy*, 15(2), 8–14. [https://doi.org/10.31548/hspedagog15\(2\).2024.8-14](https://doi.org/10.31548/hspedagog15(2).2024.8-14) [in Ukrainian].
2. Arterchuk, A., Mnykh, O., & Sadova, U. (2024). Dual education and post-war recovery of Ukraine: Factors, models, and European experience. *Transformational Economics*, 3(08), 83–88. <https://doi.org/10.32782/2786-8141/2024-8-12> [in Ukrainian].
3. Holyshch, O. (2025). Dual form of training as a condition for effective vocational education of construction workers. *Scientific Bulletin of Vinnytsia Academy of Continuing Education. Series: Pedagogy. Psychology*, 7, 27–33. <https://doi.org/10.32782/academped.psyh-2025-1.04> [in Ukrainian].
4. Kucher, O. (2023). International experience of dual education and challenges of its adaptation in Ukraine. *Alfred Nobel University Journal of Pedagogy and Psychology*, 2(26), 70–82. <https://doi.org/10.32342/2522-4115-2023-2-26-8> [in Ukrainian].
5. Mahomedova, A. M., & Pohorielova, O. S. (2021). Dual education in Ukraine: from legal support to implementation problems. *Economy. Finance. Law*, 10/1, 39–44. [https://doi.org/10.37634/efp.2021.10\(1\).8](https://doi.org/10.37634/efp.2021.10(1).8) [in Ukrainian].
6. Kulalaieva, N. V. (Ed.). (2023). *Methodological foundations for implementing elements of dual education in the professional training of future skilled workers in the construction and mechanical engineering sectors, service industry, and catering*. Institute of Vocational Education of the National Academy of Educational Sciences of Ukraine. <https://conference.ivet.edu.ua/index.php/1/en/issue/view/11/10> [in Ukrainian].
7. Novytska, O. V. (2015). Instruments for stimulating small and medium-sized businesses in the context of regional development. *Bulletin of Cherkasy State Technological University: Collection of Scientific Papers. Series: Economic Sciences*, 39, Part II, 143–149. <https://doi.org/10.24025/2306-4420.2.39.2015.84489> [in Ukrainian].
8. Novytska, O. V. (2014). Features of supporting small and medium-sized businesses in the system of modern regional management. *Bulletin of Cherkasy State Technological University: Collection of Scientific Papers. Series: Economic Sciences*, 37, Part II, 162–169 [in Ukrainian].
9. Shikina, O., & Kuznetsova, O. (2024). Dual education as a tool for the integrative development of hotel chains. *Economy and Society*, 60. <https://doi.org/10.32782/2524-0072/2024-60-27> [in Ukrainian].

10. Shykina, O. (2025). Dual education as a factor in the transformation of higher education in modern conditions. *Business Navigator*, 3(80), 594–598. <https://doi.org/10.32782/business-navigator.80-100> [in Ukrainian].
11. Yakusheva, O., & Pavlovska, A. (2022). Evolution of the theory of convergence in the context of integration of the socio-economic system of regions. *Collection of Cherkasy State Technological University. Series: Economic Sciences*, 64, 14–26. <https://doi.org/10.24025/2306-4420.64.2022.255806> [in Ukrainian].
12. Yakushev, O. (2014). World experience of cluster development: opportunities for adaptation in Ukraine. *Collection of Scientific Papers of Cherkasy State Technological University. Series: Economic Sciences*, 1(38), 167–173 [in Ukrainian].
13. Yakushev, O. V., & Yakusheva, O. V. (2018). Management of regional business processes on the basis of implementation of innovative educational clusters. *Socio-Economic Development of Regions in the Context of International Integration*, 28(17), 65–70 [in Ukrainian].
14. Yakushev, O. V., & Bilan, Ye. V. (2024). Features of managing the activities of construction enterprises in a post-conflict economy. *Economics and Organization of Management*, 2, 134–142. <https://doi.org/10.31558/2307-2318.2024.2.12> [in Ukrainian].
15. Yakushev, O. V. (2023). Development of a roadmap for intensifying the growth of IT enterprises in the regions of Ukraine. *Economics and Organization of Management*, 1(49), 131–142. <https://doi.org/10.31558/2307-2318.2023.1.13> [in Ukrainian].
16. Arnholtz, J., & Østhus, S. (2024). Is labour migration disrupting dual vocational education and training systems? Empirical evidence from the Danish and Norwegian construction sectors. *European Journal of Industrial Relations*, 30(3), 245–263. <https://doi.org/10.1177/09596801231226244>
17. Didenko, O. (2023). Development of dual (vocational) education in Ukraine before and during the full-scale invasion of the Russian Federation in Ukraine. *Social Work and Education*, 10(3), 348–360. <https://doi.org/10.25128/2520-6230.23.3.8> [in Ukrainian].
18. Euler, D. (2025). *Germany's dual vocational training system: A model for other countries?* Bertelsmann Stiftung. https://www.bertelsmann-stiftung.de/fileadmin/files/BSSt/Publikationen/GrauePublikationen/GP_Germanys_dual_vocational_training_system.pdf
19. Fernández-Salineró, C., Rodríguez-Pérez, S., Carrasco-Temiño, M. A., & Fernández-Sequí, H. (2024). Comparison of Dual VET Models in Spain: Analysing Educational Quality from the Perspective of Educational Centres. *Education Sciences*, 14(7), 779. <https://doi.org/10.3390/educsci14070779>
20. Karakai, A. (2025). *Workforce for reconstruction and dual education: How to engage business in training students*. VoxUkraine. <https://voxukraine.org/en/workforce-for-reconstruction-and-dual-education-how-to-engage-business-in-training-students>
21. Cedefop (2021). *Learning and work: The benefits of work-based learning*. European Centre for the Development of Vocational Training. https://www.cedefop.europa.eu/files/data_insight_work_experience.pdf
22. Martínez-Izquierdo, L., & Torres Sánchez, M. (2025). The adoption of dual vocational education and training in Spain: Analysis of decentralised decision-making in educational policy transfer. *Research in Comparative and International Education*, 19(4), 479–502. <https://doi.org/10.1177/17454999241280922>
23. Mordhorst, L., Jenert, T. (2022). Curricular integration of academic and vocational education: a theory-based empirical typology of dual study programmes in Germany. *High Educ*, 85, 1257–1279. <https://doi.org/10.1007/s10734-022-00889-7>
24. Federal Institute for Vocational Education and Training. (2022). *The German dual VET system in the construction sector*. UNESCO-UNEVOC International Centre. https://unevoc.unesco.org/up/BIBB_KristinaSchaefer_German-dual-VET-construction.pdf
25. Valiente, O., & Scandurra, R. (2017). Challenges to the Implementation of Dual Apprenticeships in OECD Countries [A Literature Review]. In M. Pilz (Ed.), *Vocational Education and Training in Times of Economic Crisis* (pp. 41–57). Springer. https://doi.org/10.1007/978-3-319-47856-2_3
26. Vanderhoven, E., Fontdevila, C., Langthaler, M., Valiente, O., Hermann, R., Marković, J., & Calderón, E. (2025). Realising the human development promise in dual VET. *Compare: A Journal of Comparative and International Education*, 55(3), 496–511. <https://doi.org/10.1080/03057925.2024.2309240>
27. Yakushev, O., Zachosova, N., Zhurba, I., Zubariyeva, H., & Svishchenko, H. (2022). Personnel security management of enterprise as a component of social protection and social stability in society. *Collection of Scientific Papers of Cherkasy State Technological University. Series: Economic Sciences*, 65, 4–15. <https://doi.org/10.24025/2306-4420.65.2022.262869> [in Ukrainian].
28. Hutsaliuk, O. M. (2011, April 21–22). Problems of using management technologies by industrial enterprises of Ukraine. *Materials of the International Scientific and Practical Conference «Priorities of Enterprise Development in the 21st Century»*, Part I. (pp. 145–146). Kirovograd: KOD [in Ukrainian].
29. Hutsaliuk, O. M., Remzina, N. A. (2020). Methodological foundations of forming a single through-tariff for multimodal transportation. *Central Ukrainian Scientific Bulletin. Economic Sciences*, 4(37), 169–176. [https://doi.org/10.32515/2663-1636.2020.4\(37\).169-176](https://doi.org/10.32515/2663-1636.2020.4(37).169-176) [in Ukrainian].
30. Hutsaliuk, O. M., & Obnyavko, T. S. (2021). Directions of economic and ecological transformation of enterprises of the defense-industrial complex of Ukraine. *Central Ukrainian Scientific Bulletin. Economic Sciences*, 6(39), 211–219. [https://doi.org/10.32515/2663-1636.2021.6\(39\).211-219](https://doi.org/10.32515/2663-1636.2021.6(39).211-219) [in Ukrainian].
31. Hutsaliuk, O. M., & Bondar, Iu. A. (2023, June 16). Processes of digitalization of Ukraine on the way to the EU. In *The European Union and Ukraine: prehistory, history, present day* [abstracts of the International Scientific Conference] (pp. 27–30). Mykolaiv: Petro Mohyla Black Sea National University [in Ukrainian].
32. Hutsaliuk, O., Mankuta, Ya. & Yakusheva, O. (2024). Adaptive models of management of innovative project activities of educational institutions on the basis of economic interaction and competitiveness. *Bulletin of the Bohdan Khmelnytskyi Cherkasy National University. Series «Economic Sciences»*, 28(1–2), 23–33. <https://doi.org/10.31651/2076-5843-2024-1-2-22-31>
33. Bondar, Iu. A., & Leginkova, N. I. (2021). Formation of the mechanism of innovative development of the economy of Ukraine [monograph]. *Innovative Approaches to Ensuring the Quality of Education, Scientific Research and Technological Processes* (pp. 164–172). Publishing House of University of Technology, Katowice, Poland. <http://www.wydawnictwo.wst.pl/uploads/files/3ae54f97de8a1480cfb229660e616f25.pdf> [in Ukrainian].
34. Bondar, Iu. A., & Pysmenna, M. S. (2023). The influence of social communications on the effectiveness of administrative management. *International relations: theoretical and practical aspects*, 12, 63–78. <https://doi.org/10.31866/2616-745X.12.2023.292394> [in Ukrainian].

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Bilan Ye. Dual education in the construction sector of Ukraine: a management model and implementation prospects in the context of post-war recovery

The article examines the implementation of dual education in the construction sector of Ukraine in the context of post-war economic recovery. The relevance of the study is determined by the acute shortage of qualified personnel in the construction industry, particularly skilled workers and engineering and technical specialists, which has been exacerbated by the consequences of military actions, large-scale labour migration, a decline in the working-age population, and the mismatch between educational programmes and the actual needs of construction companies. The implementation of national and international reconstruction programmes for housing, transport, and social infrastructure has intensified the demand for specialists possessing modern professional competencies, including BIM technologies, energy-efficient and sustainable construction practices, project management skills, the use of innovative materials, and compliance with international quality and occupational safety standards.

The purpose of the article is to provide a theoretical and analytical substantiation of the feasibility of implementing dual education in the construction sector of Ukraine as a model for overcoming workforce shortages and ensuring effective professional training in the context of post-war recovery. The study summarises European experience in applying dual education in technically complex industries, particularly construction, engineering, and manufacturing, and analyses domestic scientific approaches to the development of dual education within vocational and higher education systems.

The article demonstrates that dual education should be considered not only as an educational format but also as a managerial instrument for workforce provision in construction companies, capable of reducing the gap between the education system and real production processes. The key advantages of the dual model for employers are identified, including reduced costs for workforce adaptation, lower staff turnover, increased labour productivity, and decreased production and safety risks. At the same time, the study identifies major barriers to the implementation of dual education in Ukraine, such as institutional, regulatory, organisational, economic, and socio-cultural constraints that limit the active involvement of construction companies in workforce training.

The main result of the study is the development of a managerial model for implementing dual education in construction companies, which integrates dual training into the human capital management system of enterprises. The proposed model is based on a sequence of interconnected managerial blocks and is oriented toward achieving tangible business outcomes, including the formation of a stable workforce reserve, mitigation of labour shortages, improved efficiency of construction project implementation, and enhanced competitiveness of construction companies during the post-war recovery period. The practical significance of the research lies in the possibility of applying the proposed managerial model as a decision-making tool in the operational and strategic management of construction enterprises of various sizes.

Keywords: dual education, construction sector, workforce provision, managerial model, human capital, post-war recovery, construction companies.

Білан Є. В. Дуальна освіта в будівельному секторі України: управлінська модель та перспективи впровадження в умовах повоєнного відновлення

У статті досліджено проблематику впровадження дуальної освіти в будівельному секторі України в контексті повоєнного відновлення економіки. Актуальність дослідження зумовлена гострим дефіцитом кваліфікованих кадрів у будівельній галузі, зокрема робітничих та інженерно-технічних спеціальностей, що посилюється наслідками воєнних дій, масштабними міграційними процесами, скороченням працездатного населення та невідповідністю освітніх програм реальним потребам будівельних компаній. В умовах реалізації державних і міжнародних програм відбудови житлової, транспортної та соціальної інфраструктури особливої актуальності набуває підготовка фахівців із сучасними професійними компетентностями, зокрема у сфері BIM-технологій, енергоефективного та сталого будівництва, управління будівельними проектами, застосування інноваційних матеріалів і дотримання міжнародних стандартів якості та безпеки праці.

Метою статті є теоретико-аналітичне обґрунтування доцільності впровадження дуальної освіти в будівельній галузі України як моделі подолання кадрового дефіциту та забезпечення ефективної підготовки фахівців у контексті повоєнного відновлення. У межах дослідження узагальнено європейський досвід застосування дуальної освіти у технічно складних галузях, зокрема будівництві, інженерії та промисловості, а також проаналізовано вітчизняні наукові підходи до розвитку дуальної моделі професійної та вищої освіти.

У статті доведено, що дуальна освіта може розглядатися не лише як освітній формат, а як управлінський інструмент кадрового забезпечення будівельних компаній, здатний зменшувати розрив між системою освіти та реальними виробничими процесами. Проаналізовано ключові переваги дуальної моделі для роботодавців, зокрема скорочення витрат на адаптацію персоналу, зниження плинності кадрів, підвищення продуктивності праці та зменшення виробничих ризиків. Водночас ідентифіковано основні бар'єри впровадження дуальної освіти в Україні, серед яких інституційні, нормативно-правові, організаційні, економічні та соціально-культурні обмеження, що стримують активну участь будівельних компаній у підготовці кадрів.

Результатом дослідження є розроблення управлінської моделі впровадження дуальної освіти в будівельних компаніях, яка інтегрує дуальну підготовку в систему управління людським капіталом підприємства. Запропонована модель базується на послідовній реалізації управлінських блоків, орієнтованих на досягнення конкретних бізнес-результатів, зокрема формування стабільного кадрового резерву, зменшення кадрового дефіциту, підвищення ефективності реалізації будівельних проектів і конкурентоспроможності компаній у період повоєнного відновлення України. Практична значущість результатів полягає у можливості використання запропонованої моделі як інструменту управлінських рішень у діяльності будівельних підприємств різного масштабу.

Ключові слова: дуальна освіта, будівельна галузь, кадрове забезпечення, управлінська модель, людський капітал, повоєнне відновлення, будівельні компанії.