

# Transformation of higher education in Ukraine and Moldova in the context of EU integration: implementation of sustainable development goals in transport specialists' study

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## Abstract

The transformation of higher education in Ukraine and Moldova is taking place in the context of European integration, post-war reconstruction, and the transition toward sustainable economic models. The rapid development of green logistics and the need to decarbonize transport systems increase the demand for highly qualified specialists capable of managing sustainable supply chains and environmentally responsible transport solutions. In this context, Higher Education Institutions play a crucial role in preparing professionals with competencies relevant to green logistics and sustainable mobility. The EU candidate status granted to Ukraine and Moldova in 2022 accelerated reforms in technical education, including the harmonization of curricula with EU standards, alignment with the European Qualifications Framework, and the modernization of transport and logistics study programs. The study analyzes key challenges in training transport specialists, particularly skill gaps in digital technologies, environmental impact assessment, and strategic planning. The paper highlights the integration of green logistics principles, the Sustainable Development Goals, and the European Green Deal into bachelor programs through competency-based approaches and digital logistics tools. Particular attention is given to the ISDEGO, implemented within the Erasmus+, as a practical instrument for curriculum modernization and competency development in sustainable transport and logistics.

Keywords: Sustainable transport and mobility; Green logistics; Educational reforms and innovation; Sustainable Development Goals; Technical Higher Education; Transport; Logistics; Labour market.

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## 1 Introduction

The transition toward sustainable transport and green logistics requires the transformation of higher education systems to develop new competencies related to digitalization and sustainability. In this context, Ukraine and Moldova serve as case studies for analyzing how higher education adapts to the challenges of European integration and sustainable development.

### 1.1 Relevance of the study in the context of Ukraine and Moldova's European integration

The current stage of development in Ukraine and the Republic of Moldova (hereinafter referred to as Moldova) is characterised by profound socio-economic transformations caused by integration processes into the European space [1]. The European integration vector determines the need to harmonize national policies with the laws and standards of the European Union, modernize the institutional environment, and strengthen the capacity of key sectors of the economy. These processes are particularly important in the field of transport and logistics, which are

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system-forming elements of infrastructure reconstruction, domestic market development, and integration into the single European transport space.

In the context of the post-war reconstruction of Ukrainian cities and the modernization of Moldova's regional infrastructure, the training of highly qualified transport specialists is becoming a strategic priority. At the same time, the labor market needs a new generation of specialists capable of implementing the principles of sustainable mobility, energy efficiency, inclusiveness, and digital transformation. This necessitates updating the content of technical higher education to consider modern European approaches and global challenges of sustainable development.

### *1.2 EU candidate status as a factor in educational transformation*

In June 2022, the European Council granted Ukraine and Moldova candidate status for membership in the European Union, which was a historic step in the development of both countries. Obtaining this status not only consolidated the political course towards European integration, but also marked the beginning of a new stage of structural reforms, particularly in the field of education [2].

The implementation of the *Acquis Communautaire* [3] involves adapting education legislation, ensuring the quality of higher education in line with European standards, developing academic mobility, and integrating innovative approaches to learning. Technical and transport education play a special role in this process, as they shape the human resources potential for the implementation of infrastructure projects, the modernization of transport systems, and integration into trans-European networks. Thus, candidate status has become a catalyst for rethinking the content of educational programs and transitioning to a competency-based model of training specialists.

### *1.3 The role of the Sustainable Development Goals (SDGs) and the European Green Deal in reforming higher education*

The United Nations Sustainable Development Goals and the European Union's strategic initiatives, in particular the European Green Deal [4], are important benchmarks for the transformation of education systems. The integration of sustainable development principles into the educational process is aimed at shaping the environmental awareness, social responsibility, and innovative thinking of future professionals.

For the transport sector, this means reorienting towards sustainable mobility models, reducing greenhouse gas emissions, developing low-carbon urban freight logistics, and introducing digital transport management technologies. Universities are key agents of change, integrating issues of energy efficiency, smart logistics, transport flow management, and inclusive spatial planning into their curricula. In this way, education becomes a tool for implementing both global and regional sustainable development strategies.

*The purpose of the paper* is to analyze the transformation of training specialists in the transport sector in Ukraine and Moldova in the context of European integration and the implementation of the Sustainable Development Goals, as well as to identify key areas for modernizing educational programs in line with the requirements of sustainable transport, digital logistics, and green logistics.

To achieve this goal, the following tasks are to be accomplished:

- Analyze the impact of European integration processes on the reform of technical higher education;
- To identify the current challenges of training transport specialists in the context of post-war reconstruction and regional modernization;
- To justify the importance of integrating the principles of sustainable development and the European Green Deal into the content of educational programs;
- To characterize innovative approaches to the formation of competencies in the field of sustainable mobility, urban logistics, and transport digitalization.

The proposed study aims to develop conceptual foundations for the modernization of transport education that are consistent with the strategic goals of integration into the European educational and economic space.

*The paper is structured as follows:* Section 2 presents the European integration context of higher education transformation, Section 3 analyzes the main challenges in training transport specialists, and Section 4 discusses the role of the ISDEGO project in modernizing educational programs, followed by the conclusions.

## **2 European integration context of higher education transformation**

### *2.1 Harmonization of national legislation with EU standards*

According to the European Commission's conclusions on membership applications (2022) [5-6], one of the key tasks for Ukraine and Moldova, as candidates for accession to the European Union, is to ensure independent and

effective mechanisms for guaranteeing the quality of higher education, transparency of management, and alignment of qualifications with the European Qualifications Framework (EQF).

Ukraine and Moldova have been participants in the Bologna Process since 2005, which provides for the functioning of a three-cycle education system (bachelor's–master's–doctor of philosophy), the application of ECTS, and the development of academic mobility. As of 2023, there are 49 participating countries in the European Higher Education Area (EHEA), which forms a common regulatory and value space for the harmonization of education policies [7-8].

According to the Ministry of Education and Science of Ukraine, in the 2023/2024 academic year, there were more than 300 higher education institutions in Ukraine, with approximately 1.3 million students. In Moldova, according to the National Bureau of Statistics, there were 16 universities in 2023, with more than 56,000 students. These figures demonstrate the scale of the task of adapting the education system to European standards.

The harmonization of legislation also covers the implementation of EU sectoral policies in the areas of transport, energy efficiency, and climate neutrality. In particular, the EU transport sector is responsible for approximately 25% of total greenhouse gas emissions, which necessitates the integration of environmental requirements into the professional training of specialists (European Environment Agency, 2022).

## 2.2 Educational reforms in technical higher education

The modernization of technical higher education in Ukraine and Moldova is being driven by structural changes in the labor market and the digital transformation of the economy. According to a report by the World Economic Forum (2023), more than 44% of key professional skills will undergo transformation over the next five years, highlighting the need to review the content of engineering and transport education.

In Ukraine, the transport sector accounts for about 6–7% of GDP and is critical to the functioning of an export-oriented economy. During the full-scale war, logistics routes were significantly transformed, highlighting the need for specialists in multimodal transport management, urban logistics, and digital transport systems.

The reform of technical education involves:

- A transition to a competency-based approach;
- The expansion of dual education;
- The integration of digital technologies (Big Data, IoT, artificial intelligence);
- Strengthened cooperation between universities, businesses, and local authorities.

Of particular importance is the participation of universities in the Erasmus+ program, which has a budget of over €26 billion for the period 2021–2027 and supports the modernization of educational programs, academic mobility, and the creation of international consortia [10].

## 3 Modern challenges in the training of transport specialists

### 3.1 Labor market needs in the context of economic recovery

The recovery of Ukraine's economy after large-scale destruction of transport infrastructure is creating a fundamentally new demand for personnel in the transport and logistics sector. One of the key findings of the World Bank report is the acute labor shortage in the transport sector, which is already negatively affecting the operational capacity of transport companies and hindering economic recovery. According to employer surveys in 2024–2025, up to 45% of transport companies reported difficulties in recruiting staff (Fig.1), including drivers, mechanics, and managers, with an expected average staff growth of approximately 4% in 2025 [9].

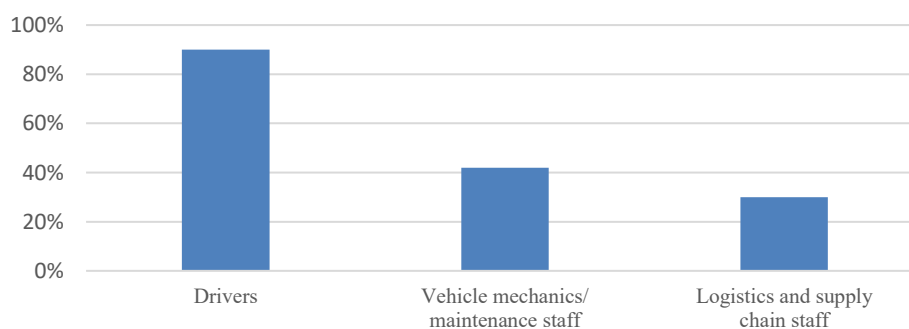


Fig.1 Transportation jobs in highest demand in Ukraine in 2025, according to the source [9]

This shortage of human resources is structural rather than temporary: it is caused by demographic decline, mobilization, and significant population migration. Demographic trends are leading to an aging workforce, and

young people are less likely to choose professions involving physically demanding work and irregular schedules, such as freight transport and maintenance. This situation intensifies competition for skilled professionals in the labor market and increases wages in key categories, indicating an imbalance between labor supply and demand.

At the same time, global trends point to a profound transformation of professions: according to World Economic Forum (2025) forecasts, 78 million new jobs will be created by 2030, but more than 40% of skills will be updated (Table 1).

Thus, the system of training transport specialists must respond to a complex challenge: simultaneous restoration of physical infrastructure and integration into a digital and environmentally-oriented economic model.

Table 1. Key factors shaping demand for transport specialists

Factor	Impact on the labor market	Implications for education
Post-war reconstruction (Ukrainian context)	Growing demand for engineers and logisticians	Strengthening infrastructure courses
European integration	Harmonization with TEN-T, EU standards	Inclusion of international regulatory standards
Digitalization	Demand for data analysts and IT specialists in logistics	Integration of IoT, Big Data, and AI into curricula
Decarbonization	Demand for experts in sustainable mobility	Education in energy efficiency and environmental management

In Moldova, the transition toward sustainable transport is constrained by structural challenges such as fragmented regional infrastructure, limited multimodal logistics integration, and significant disparities between urban and rural mobility systems. These factors directly affect the demand for transport professionals equipped with competencies in sustainable regional planning and smart logistics solutions.

A critical constraint for Moldova’s transport and logistics sector is the persistent migration of skilled labour, including engineers and technical specialists. This trend creates structural workforce shortages and increases the need for higher education institutions to train specialists capable not only of meeting domestic labour market needs but also of contributing to the modernization of transport systems aligned with EU standards.

### 3.2 Competency requirements for specialists in the field of sustainable transport and logistics

The modern transport sector is operating in the context of the transition to a climate-neutral economy. In the EU, transport generates around 25% of greenhouse gas emissions, which means that emissions must be reduced by 90% by 2050. This sets new requirements for the professional training of specialists (Table 2).

Table 2. Priority competencies for sustainable transport specialist

Group of competencies	Contents
Environmental	Environmental impact assessment, decarbonization, risk management
Digital	TMS, WMS, IoT, Big Data, GIS, AI
Analytical	Optimization of multimodal transport
Management	Project management, strategic planning
Social	Communication, intercultural interaction

At the same time, the World Bank report “On the road to recovery: Addressing Ukraine's transport labor shortages” [9] states that, in addition to the general labor shortage, there are significant discrepancies between the skills possessed by graduates of educational programs and the competencies expected by employers. In particular, new employees often lack the practical experience or digital skills necessary to work effectively with modern transport management information systems, telematics, or integrated logistics platforms.

Thus, educational programs that focus primarily on traditional knowledge and do not integrate modern practical competencies do not adequately prepare specialists to work in the context of the digital transformation of the transport industry and the transition to sustainable logistics. This reinforces the need for a systematic modernization of curricula, including practical internships, dual education, and close cooperation with employers.

In the case of Moldova, the transformation of transport education is influenced by specific structural constraints, including aging infrastructure, regional mobility disparities, migration-driven workforce shortages, and limited financial capacity for green transport investments. At the same time, Moldova’s emerging role as a future EU-border logistics interface creates new demands for specialists in cross-border mobility, digital logistics, and sustainable transport planning. These factors reinforce the need for stronger university–industry collaboration and competency-based training aligned with European standards.

### Forecasts for the development of Ukraine's transport sector

Forecasts for the development of Ukraine's transport sector indicate a significant increase in labor demand in the medium and long term. According to the results presented in [9], modeling the elasticity of employment in the transport sector to GDP growth, the number of employees in selected sub-sectors of road and urban public transport, which stood at around 400,000 in 2023, could grow to almost 594,000 by 2035 under a baseline scenario of moderate economic growth.

Alternative scenarios show an even wider range of possible changes: with lower GDP growth, the number of people employed could be around 519,000, while with a scenario of accelerated economic recovery, it could be up to 660,000. Thus, the projected growth in the number of employees in the motor transport sector by 2035 will be between 30% and 65% compared to 2023. Even under a conservative scenario, which considers moderate economic growth and cautious assumptions about employee retirement, it is expected that at least 100,000 new employees will need to be hired in the coming years.

It should be emphasized that these forecasts do not consider possible structural changes related to automation, digitization of traffic management, or potential infrastructure risks. At the same time, they clearly outline the scale of the staffing challenge facing the vocational and higher technical education system.

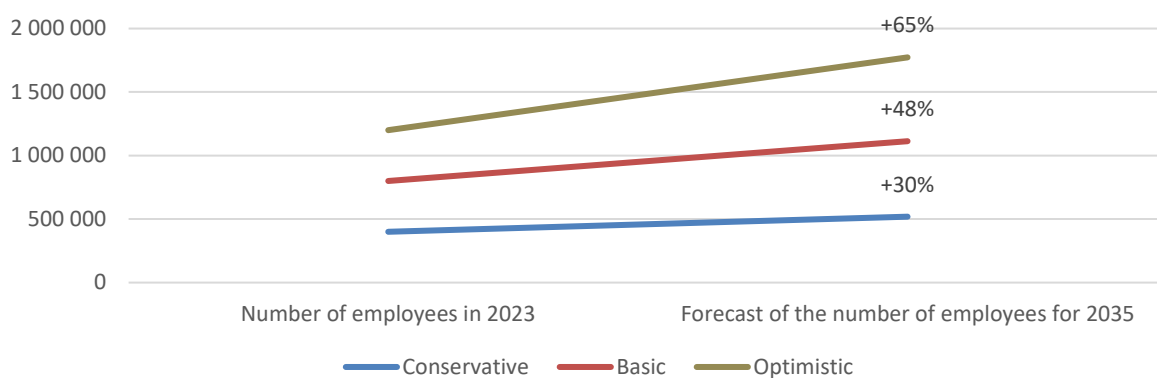


Fig.2 Modelling the elasticity of employment in the transport sector of Ukraine according to GDP growth, based on data from [9]

Therefore, the scale of expected employment growth in the transport sector confirms the need for a strategic update of educational programs. The training of transport specialists should be focused not only on replacing departing personnel, but also on forming a new generation of professionals capable of working in conditions of digital transformation, environmental modernization, and integration into the European transport services market.

In addition, international integration requires the harmonization of educational programs with international standards and qualification frameworks. The key benchmarks are:

- European Qualifications Framework (EQF);
- ISO standards in logistics and quality management;
- ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road);
- Trans-European Transport Network (TEN-T) standards.

At the same time, Moldova's geographical position as a future EU-border logistics interface increases the strategic importance of developing competencies in cross-border transport management, TEN-T integration, and sustainable freight mobility.

## 4 The ISDEGO project as a tool for transforming the training of transport specialists

### 4.1 Background and university consortium

The ISDEGO (Implementation of Sustainable Urban Development Goals in Transport Bachelor Degree) project [11] was initiated in response to the structural challenges of modernizing the transport sector in Ukraine and Moldova in the context of European integration, post-war reconstruction, green logistics and the transition to a climate-neutral economy. The prerequisites for its creation were:

- The need to harmonize educational programs with EU requirements;
- Staff shortages in the transport sector;
- The need to integrate Sustainable Development Goals (SDGs) into technical education;
- The development of digital competencies in the field of logistics and mobility.

The project is being implemented within the Erasmus+ program (CBHE, KA2) and brings together universities from Ukraine, Moldova, and EU countries. The consortium is formed on the principle of interdisciplinarity and multi-level.

#### *Consortium structure*

The ISDEGO consortium is formed on the principle of regional balance and interdisciplinarity and includes:

- Higher education institutions in Ukraine that provide updates and implementation of bachelor's programs in the field of transport, logistics, and urban infrastructure: National Transport University (Kyiv, Ukraine); O.M. Beketov National University of Urban Economy in Kharkiv (Kharkiv, Ukraine); The National University of Water and Environmental Engineering (Rivne, Ukraine) and National University Zaporizhzhia Polytechnic (Zaporizhzhya, Ukraine).
- Universities in the Republic of Moldova that adapt training modules to the national context and regional needs: Universitatea Tehnica a Moldovei (Chisinau, Moldova); Universitatea de Stat Alecu Russo din Balti (Balti, Moldova).
- Partner universities in EU countries, which act as academic mentors, transfer best practices from the European Higher Education Area, and provide expert support on SDG integration, digitalization, and innovative pedagogical approaches: Politechnika Morska w Szczecinie (Szczecin, Poland); Hochschule Wismar University of Applied Sciences Technology, Business and Design (Wismar, Germany); Università degli Studi di Roma Tor Vergata (Roma, Italy); Universitatea Transilvania din Brasov (Brasov, Romania).
- Associated partners – local authorities, transport companies, logistics companies, and professional associations that provide links to the labor market.

The consortium composition combines academic expertise, practical experience, and a management perspective in line with the principles of Erasmus+ CBHE (Capacity Building in Higher Education).

#### *4.2 Project goals and objectives*

The main goal of ISDEGO is to modernize bachelor's degree programs in the field of transport by integrating the principles of sustainable development, digital technologies, green logistics and European educational standards.

The key objectives of the project include:

1. Analysis of labor market needs and existing educational programs.
2. Developing and updating curricula in line with SDG 11 (Sustainable Cities and Communities).
3. Introducing innovative training modules on digital logistics, smart mobility, green logistics and urban freight transport.
4. Improving teacher qualifications and developing teaching materials.
5. Building partnerships with employers and municipalities.

The project aims to train a new generation of specialists capable of ensuring the sustainable development of urban and regional transport systems in line with the European Green Deal [12-14].

One of the central outcomes of the project is the development of innovative modules for the bachelor's program that integrate technical, environmental, and digital components. The updated program structure includes modules on sustainable urban mobility; urban freight logistics management; digital technologies (IoT, GIS, Big Data, AI) in transport; energy efficiency and decarbonization of transport systems.

The program is characterized by a competency-based approach and interdisciplinary integration. Significant attention is paid to practice-oriented learning, the use of case methods, simulations, digital platforms, and cooperation with municipalities and logistics companies.

The results of the analytical stage of the ISDEGO project (T2.1) [10] demonstrated the need for a systematic update of bachelor's programs in the field of transport and urban development in line with global labor market transformations, digitalization, and environmental challenges. The study analyzed 28 international strategic documents (OECD, World Bank, WEF, ILO, EU, UNDP, etc.) some are presented here [12-20], which made it possible to identify key areas for reforming the content of technical education. Based on the analysis, six new competencies were proposed to be integrated into bachelor's programs, namely:

1. Integration of sustainability principles into urban and transport planning;
2. Use of digital and smart technologies in infrastructure;
3. Management of transport and logistics systems;
4. Project and policy management in the field of sustainable mobility;
5. Strategic interaction between education and the labor market;
6. Intercultural communication and leadership.

Empirical validation of these competencies was provided by a series of stakeholder seminars held in April 2025 at four Ukrainian and two Moldovan universities. As part of the stakeholder engagement process, respondents were asked to identify the most relevant competences required in their specific professional context.

The feedback received to determine priority areas for development – with particular emphasis on digital tools and environmental impact assessment, which emerged as key focus points for future capacity-building efforts (Fig. 3).

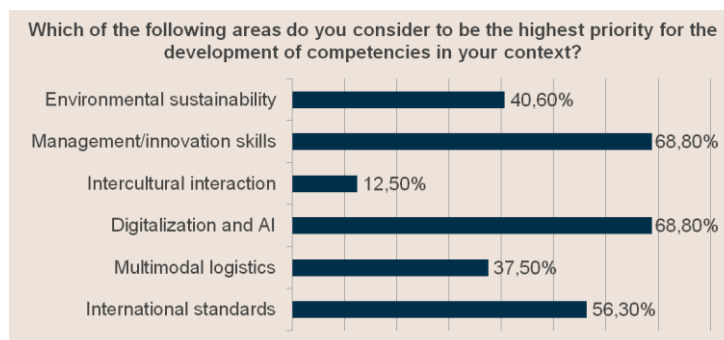


Fig. 3 Priority areas for competence development according to stakeholders' survey in ISDEGO project

Stakeholders were subsequently asked to assess the relevance of the proposed new competences for the development or revision of bachelor-level curricula. The feedback gathered serves as a key input in shaping the structure of new course modules and the development of corresponding teaching materials in the ISDEGO project (Fig.4).

The final stage, respondents were invited to reflect on the current gaps in graduate competencies (Fig.5). The majority emphasized that, despite an adequate level of technical knowledge, graduates frequently lack essential skills in the areas of digital literacy, strategic planning, and intercultural communication. These findings reinforce the relevance of the proposed competency framework and confirm the appropriateness of the direction in curriculum development.



Fig. 4 Stakeholder Assessment of the Relevance of Proposed New Competencies for Bachelor Curriculum Development

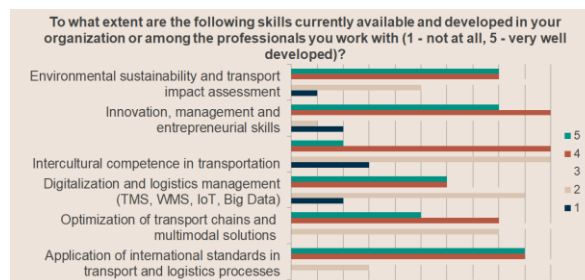


Fig. 5 Assessment of the Current Availability and Development of Key Skills in Transport and Logistics Professionals

The results of stakeholder surveys showed that environmental assessment of transport impact and digital logistics are identified as key areas for competence development. At the same time, the need to combine technical knowledge with systematic thinking and the ability to assess the long-term socio-economic and environmental consequences of transport decisions is emphasized.

The expected results of implementing the proposed changes are the formation of basic 21st-century skills in students – analytical thinking, complex problem solving, critical analysis, adaptability, and active learning. These competencies are consistent with global forecasts for future skills (WEF, OECD) [18, 20], and strengthen graduates' ability to operate in the context of green and digital transformation.

Therefore, the integration of sustainable development principles into transport-related educational programs should be carried out not only through individual courses, but also through a comprehensive modernization of the structure of bachelor's degree programs. The model proposed within ISDEGO demonstrates an example of an evidence-based approach to educational transformation that combines international standards, regional needs, and cross-sectoral interaction.

## 5 Conclusion

The ISDEGO project (Implementation of Sustainable Urban Development Goals in Transport Bachelor Degree) within the Erasmus+ program is a systematic tool for transforming the training of transport specialists, combining European standards, sustainable development principles, and digital innovations. Its implementation forms the basis for training competitive specialists capable of ensuring the restoration and modernization of transport infrastructure in the context of European integration.

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