STUDENTS TRAINING

EU-BASED METHODS

A PRACTICAL MANUAL FOR HIGHER EDUCATION

EMINReM

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National peculiarities of Ukrainian, Kazakh and Uzbek higher educational systems, evaluation systems analysis and methodologies are described. The Bologna Process profile in EU countries is revealed. European ECTS system is examined, using advanced methods and approaches for students training.
International mobility and studying/traineeships outcome recognition, distance learning implementation features and innovative European teaching methods are described. Higher education development perspectives in Europe, Ukraine, Kazakh and Uzbek are outlined.
For teachers, students and higher educational institutions staff.

CONTENT

THE SHORTENINGS LIST

ACWP	Academic Course Working Program
AR	Augmented Reality
BAT	Best Available Technologies
BFUG	Bologna Follow-Up Group
BL	Blended Learning
CBHE	Capacity Building in Higher Education
DS	Diploma Supplement
DL	Distance Learning
ECHE	Erasmus Charter for Higher Education
ECTS	European Credit Transfer and Accumulation System
EHEA	European Higher Education Area
EMINReM	Eco-Mining and Innovative Natural Resources Management
EQF	European Qualifications Framework
ESG	Standards and Guidelines for Quality Assurance in the European Higher Education Area
EU	European Union
HEI	Higher Education Institution
HES	Higher Education System
HL	Hybrid Learning
ICT	Information and Communication Technologies
IIA	Inter-Institutional Agreement
KA2	Key Action 2
LA	Learning Agreement
LLL	Lifelong Learning
LMS	Learning Management System
LO	Learning Outcomes
MSc	Master of Science
MTM	Modern Teaching Methods
NARIC	National Academic Recognition Information Centre

NQF	National Qualifications Framework
OL	Online Learning
QA	Quality Assurance
QF-EHEA	Qualifications Framework for the European Higher Education Area
SCL	Student-Centred Learning
TCL	Teacher-Centred Learning
VET	Vocational Education and Training
VR	Virtual Reality

INTRODUCTION

Since the launch of the Bologna Process, higher education systems in Europe and partner countries have undergone significant changes aimed at improving transparency, comparability, quality assurance and international cooperation. Ukraine, Kazakhstan and Uzbekistan have paid particular attention to European approaches to higher education modernization, including the development of competence-based curricula, the use of credit systems, academic mobility, recognition of learning outcomes and student-centred teaching methods.

The Bologna Process is a major European initiative aimed at creating a more coherent, comparable and competitive higher education area. It supports the modernization of national higher education systems, strengthens their connection with the needs of society and the labour market, and increases the contribution of universities to economic, scientific and innovative development. In this context, Ukraine and Kazakhstan participate in the European Higher Education Area, while Uzbekistan is actively modernizing its higher education system and developing approaches compatible with international and European standards.

The development of cooperation between European and partner country universities creates new opportunities for academic dialogue, joint educational initiatives, mobility, curriculum modernization and research collaboration. For technical and engineering universities, such cooperation is especially important, as it helps to improve the quality of education, introduce modern teaching methods and prepare specialists capable of working in an international professional environment.

The Bologna Process participants committed themselves to establishing a common European Higher Education Area and increasing the international attractiveness and competitiveness of European higher education.

The main principles and measures of this process include the following:

Introduction of clear and comparable academic degrees. This principle is supported by the use of the Diploma Supplement, which provides transparent information about the

qualification holder, type and level of qualification, content of studies, learning outcomes, grading system and national higher education system. The Diploma Supplement facilitates academic and professional recognition and supports graduates' mobility and employability.

Development of a multi-cycle higher education system. The Bologna model is based on a system of higher education cycles, including Bachelor's, Master's and Doctoral levels. Access to the next cycle is normally possible after successful completion of the previous one. This structure makes higher education qualifications more transparent and comparable across countries and supports academic and professional mobility.

Implementation of the European Credit Transfer and Accumulation System.
ECTS is used to ensure transparency of study programmes, student workload, learning outcomes and credit recognition. It supports the comparison of educational components, accumulation and transfer of credits, and recognition of academic achievements obtained at different higher education institutions, including during mobility periods.

Promotion of academic mobility.
Student, teacher, researcher and administrative staff mobility is one of the key priorities of the European Higher Education Area. Mobility allows participants to gain international academic and professional experience, develop intercultural communication skills, access new learning and research environments, and strengthen cooperation between partner institutions.

Strengthening quality assurance and student-centred learning.
Modern higher education increasingly focuses on transparent quality assurance procedures, learning outcomes, competence-based education and the active role of students in the learning process. These principles are essential for developing educational programmes that meet both academic standards and the practical needs of modern society.

Within the framework of the Erasmus+ EMINReM project, these principles are applied to the modernization of education in eco-mining and innovative natural resources management. The project supports cooperation between higher education institutions in Ukraine, Kazakhstan, Uzbekistan and the European Union, promotes academic mobility, develops new

and updated educational components, and introduces innovative teaching methods based on European experience.

Particular attention is paid to the use of EU-based approaches in technical and engineering education, including ECTS, learning outcomes, quality assurance, student-centred learning, digital tools, gamification, blended learning and practice-oriented teaching methods. These approaches help students acquire not only theoretical knowledge, but also practical skills, research competencies and the ability to solve complex professional problems in the fields of sustainable mining, environmental protection and natural resources management.

The manual is intended for teachers, students, administrative staff and higher education institutions involved in the modernization of educational programmes and international cooperation. It provides an overview of European educational principles and methods, academic mobility and recognition procedures, innovative teaching approaches and development perspectives for higher education in Ukraine, Kazakhstan and Uzbekistan in the context of eco-mining and sustainable natural resources management.

1. EUROPEAN HIGHER EDUCATION AREA AND PARTNER COUNTRIES' EDUCATIONAL CONTEXT

1.1. Bologna Process and Its Main Principles

In 1988, the rectors of universities from EU member states and associated countries signed the Magna Charta Universitatum in Bologna. As the document was signed by the academic community members only, it had no political dimension and differed in nature from documents in the later framework of the Bologna Process. Magna Charta Universitatum emphasized the role of the university as a guardian of values and stressed the importance of freedom to pursue academic research. As stated, "its research and teaching must be independent of all political authority and economic power". Characterized as autotelic and conducted along the principle of autonomy, research and teaching was to serve the public; issues related to building a knowledge-based economy were not included in the document. Also, what was recognized as one of the main concerns of the university was the responsibility for the preservation and development of the European humanist tradition.

In order to understand the changes taking place in European higher education, it is worth introducing and explaining the origins of the Bologna Declaration and the ensuing set of higher education reforms referred to as the Bologna Process. The basic principles of the Bologna process stem from the Joint Declaration on Harmonization of the Architecture of the European Higher Education, signed in May, 1998 at the Sorbonne in Paris by the education ministers of four countries: France, Germany, Italy and the United Kingdom. The Sorbonne Declaration focused on improving international transparency and comparability of studies, including the recognition of qualifications through the introduction of a common qualifications framework and consistent study levels. It also aimed to promote the mobility of students and teachers across Europe and their integration into the European labor market, and addressed the issue of creating a common system of titles and degrees for undergraduate and graduate cycles (respectively BSc degree and MSc and doctor's degree).

An important point of departure for considering changes taking place in higher education was the Bologna Declaration, signed by the ministers responsible for higher education from twenty-nine countries on 19 June 1999. The document provided the Bologna Process with the initial sense of direction. At that stage, the final form, in which the HEIs were to operate at the level of associated countries, was not specified. The idea was to be developed with each subsequent meeting at the ministerial level to include additional goals. The Bologna Declaration became the founding document used by the signatory states to establish the general framework for the European higher education modernization and reform.

In later documents, subsequent reforms in higher education came to be referred to as the Bologna Process. In the Bologna Declaration, the ministers committed their countries to introduce changes in their educational systems with a view to attaining the following objectives:

- easily readable and comparable degrees system adoption;
- adoption of a system essentially based on two main cycles (undergraduate and graduate);
- establishment of a European credits system based on the student workload required to achieve the course outcomes (ECTS) as a means of accumulation and transfer of credits;
- promotion of staff and student mobility;
- cooperation in QA;
- promotion of the European dimension in higher education.

The progress of the implementation of the Bologna Process recommendations is regularly monitored at conferences of ministers responsible for higher education meeting every two years concluding with a "communiqué" summarizing of the achievements and further action defining. Originally, the principal objective of the Bologna Process was to create the European Higher Education Area (EHEA) by 2010. Once this aim was accomplished, the agenda of the process has been broadened to include such goals as the current development of National Qualifications Frameworks (NQF) compatible with the overarching Framework for Qualifications of the European Higher Education Area (FQ-EHEA) as a means to increase mobility.

The most important documents defining the area of the Bologna Process influence are declarations and "communiqués"

signed by the ministers responsible for higher education. The number of countries is steadily increasing, from twenty-nine in 1999 to forty-six in 2013, and so is the number of tasks. In the Prague Communiqué (2001), the ministers added new elements: promotion of lifelong learning (LLL), cooperation with HEIs and students and promotion of the EHEA attractiveness in Europe and around the world. The Berlin Communiqué (2003) assessed the progress made so far and stressed the significance of a link between higher education and research. In this context, it was considered important that the two-cycle study system should be modified to include the doctoral level as the third cycle. The Bergen Conference (2005) set the priorities for the Bologna Process for the following years: the development of doctoral studies and linking higher education with research. It also stressed the social dimension of the Bologna Process involving access to studies for students from socially disadvantaged groups and removing obstacles to student and staff mobility.

One of the postulates was to develop mechanisms, which would enable comparing the equivalence of skills acquired by students and their educational achievement, with European Qualifications Frameworks (EQFO and NQF as tools for this goal implementation. The London Communiqué (2007) assessed the level of achievement of the previously set objectives and stressed the need for implementation of the new approach to education focused on student needs and learning outcomes. The conference in Leuven and Louvain-la-Neuve (2009) re-emphasized the social dimension of higher education (providing equal opportunities for education and adequate conditions for the completion of studies), links among HEIs and the labor market, between education and research and innovation, and increasing students and staff mobility. Another issue addressed was the need to create databases in order to efficiently monitor progress made in the areas of mobility, social dimension and employability, as well as to provide the basis for stocktaking and benchmarking (including HEIs classification and ranking). 2010 saw the EHEA officially launched at the Budapest and Vienna Conference. In Bucharest (2012), providing quality higher education in order to enhance employability of graduates and strengthening mobility for better learning were identified as important elements of further action.

Table 1. The Bologna Process: Major stages

Conference of ministers responsible for higher education	Declaration/ communiqué date	Number of countries participating on the conference	Priority action
Bologna	19 June 1999	29	- adoption of a system of easily readable and comparable degrees through the DS implementation - adoption of a HES based on two/three main cycles - establishment of a European system of credits (ECTS) - promotion of student, teachers, researchers and administrative staff mobility - promotion of a European dimension in higher education, particularly with regard to curricular development, mobility schemes and integrated programmes of study, training and research
Prague	19 May 2001	33	New elements: - LLL promotion - stress on involvement of HEIs and students - promotion of the attractiveness of the EHEA in Europe and other parts of the world
Berlin	19 September 2003	40	New elements, including: - modification of the two-cycle study system to include the doctoral level as the third cycle - development of interdisciplinary education
Bergen	19-20 May 2005	45	Priorities: - intensification of links between education and research e.g. by improving cooperation between the higher education sector and other research sectors - increasing access to studies for students from all social groups, including those in difficult financial and economic situation - removing obstacles to student and staff mobility
London	18 May 2007	46	Further action focused on: - removing obstacles to student and staff mobility - securing equal access to studies

			- improving employability of graduates of the three-cycle degree system - promoting the principles of the Bologna Process in other regions of the world
Leuven and Louvain-la-Neuve	28-29 April 2009	47	Further aims and priorities: - providing equal opportunities for education and adequate conditions for the completion of studies - developing LLL, with a particular focus on the development of NQF - promoting employability of graduates and links between HEIs and labour market - empowering students in the educational process and in the process of curricular reform of higher education - internationalization of studies - guaranteeing funding
Budapest and Vienna	12 March 2010	47	Official launch of the EHEA and an assessment of the first decade of the Bologna Process
Bucharest	26-27 April 2012	47	Main priorities: - providing quality higher education for all - enhancing employability of graduates - strengthening mobility

So far, the strategic objectives adopted in the Bologna Declaration have been implemented in most EHEA countries. An assessment of the process prior to 2010 was provided in a report Higher Education in Europe 2009: Developments in the Bologna Process and the latest data are included in the EHEA in 2012: Bologna Process Implementation Report. Both of them were based on data from the Eurostat, Eurostudent project and Eurydice network and were supervised by the Bologna Follow-Up Group (BFUG). The 2012 report reveals that the European HES have transformed as set out in the Bologna Process principles. It has been observed that a high proportion of students continue their education having completed their first cycle with BSc degree (or its equivalent). In view of the fact that some countries still do not recognize the BSc degree as a professional qualification, it is suggested that further action should be taken to transform the traditional system towards a system based on LO. Although practically all countries have established external systems of quality assurance (QA), their agencies greatly differ in

their purpose and approach: while the majority of them are primarily supervisory, some of them have only an advisory role. Furthermore, the systems of QA still require greater involvement on the part of students, academic staff and employers. It is worth noting that despite the development of the European Quality Assurance Register, many countries still do not allow their HEIs to be evaluated by foreign agencies.

Another point of evaluation of the Bologna Process considers the LLL implementation. Although most countries have recognized this idea as one of their priorities and modified their study offer accordingly, the level of implementation is considerably different, owing to such factors as the level of financing available for the purpose.

New aims and objectives defined after 2010 can prove to be more difficult to implement than the previous ones. They include such elements as the introduction of flexible learning pathways, learning in the work environment and recognition of non-formal education and informal learning, which are a part of the European Qualifications Framework for Lifelong Learning (EQF-LLL), mostly related to the field of vocational training. Another strategic task is to adjust the educational sector to the needs of the labor market. A significant number of countries have not yet taken all the steps to modernize their system of vocational training in accordance with the new guidelines. As indicated in the materials made available so far, it can be assumed that HEIs will have a considerable level of autonomy in shaping their validation schemes (for example, the validation of qualifications by one HEI can be autonomously accepted or rejected by another institution actually admitting the student).

In their activity related to the Bologna Process, the ministers responsible for higher education are assisted by three official-level groups which supervise work, facilitate communication and assist in the decision-making process: the BFUG (established in 2003 and responsible for planning and implementation of activity stemming from ministerial decisions), the Bologna Process Board (supervising the activity of BFUG and responsible for action between BFUG meetings) and the Bologna Secretariat (supporting the work of BFUG and providing information about the Bologna Process).

Apart from states, the process also includes the European Commission as a full member, the Council of Europe and

UNESCO-CEPES (European Centre for Higher Education) as consultative members, and a range of stakeholder organization also as consultative members. In this way, there is full and active partnership with HEIs, represented by the European University Association (EUA) and EURASHE, students, represented by the European Students' Union (ESU), academics represented by Education International (EI) and other stakeholder organizations such as the European Association for Quality Assurance in Higher Education (ENQA) and Business Europe representing employer organizations.

Since the Bologna Process is an inter-governmental process of higher education reform within the EHEA, the European Commission has become involved as a full member, increasingly important due to the level of its financial contribution. This is related to the development of the European Research Area (ERA) and to the fact that the Bologna Process is a tool in the implementation of the Lisbon Strategy. According to some specialists, the role of the European Commission has grown so considerably that the Bologna Process has become subordinated to the Lisbon Strategy, particularly to the measures adopted to ensure economic growth and increasing employment. It is also Europe 2020, a new European strategy to replace its Lisbon predecessor that emphasizes the so-called smart growth, based on investments in education, research and innovation, as the main source of economic growth as such. This comes as an indication of a further increase in expectations from the higher education sector.

1.2. Approaches to Higher Education Modernization

Modernization of higher education in Europe is closely connected with the development of the European Higher Education Area, the implementation of the Bologna Process principles, and the growing need to prepare graduates for rapidly changing social, economic, technological and environmental conditions [1]. European higher education institutions are expected not only to provide academic knowledge, but also to develop practical skills, professional

competencies, critical thinking, creativity, digital literacy and the ability to learn throughout life [2].

One of the key European approaches to higher education modernization is the transition from a teacher-centred model to a student-centred model of learning. In traditional education, the teacher is usually the main source of knowledge, while students mainly receive, memorize and reproduce information. In contrast, student-centred learning gives students a more active role in the educational process. They participate in discussions, solve practical tasks, work on projects, analyse case studies, carry out independent research and take responsibility for their own learning progress [3].

Student-centred learning is closely related to the concept of learning outcomes. A modern educational programme should clearly define what a student is expected to know, understand and be able to do after completing a course, module or programme. This approach makes education more transparent and comparable, supports quality assurance and helps align study programmes with the needs of society and the labour market [4]. Learning outcomes also make it easier to organize academic mobility and recognize study periods completed at another higher education institution.

Another important direction of modernization is competence-based education. European higher education increasingly focuses on the development of competencies that combine knowledge, practical skills, communication, autonomy and responsibility. This is especially important for technical and engineering education, where graduates must be able to apply theoretical knowledge to real professional situations, make decisions, work with modern technologies, assess risks and cooperate with specialists from different fields.

The European Credit Transfer and Accumulation System is also an essential modernization tool. ECTS supports the transparency of study programmes, student workload and learning outcomes. It allows credits to be accumulated and transferred between institutions and countries, which is particularly important for academic mobility [4]. Through ECTS, higher education institutions can better compare educational components, recognize learning achievements and design programmes that are understandable for students, partner universities and employers.

Quality assurance is another central element of European higher education modernization. It includes internal and external procedures aimed at improving the quality of teaching, learning, assessment, research and institutional management. Quality assurance is not limited to formal control. It should help universities continuously improve educational programmes, involve students and stakeholders, update curricula and ensure that graduates acquire relevant competencies. In this context, the Standards and Guidelines for Quality Assurance in the European Higher Education Area provide a common framework for quality culture development [5].

Internationalization is also one of the most visible features of modern European higher education. It includes academic mobility, joint educational programmes, international research cooperation, participation in Erasmus+ projects, development of courses in foreign languages, intercultural communication and cooperation between universities from different countries. Internationalization helps students and teachers gain broader academic and professional experience and strengthens the competitiveness of higher education institutions [1].

Digital transformation has become an important part of higher education modernization. Universities increasingly use learning management systems, online platforms, digital libraries, virtual laboratories, video lectures, simulations, artificial intelligence tools and other digital resources. Digital technologies support distance, blended and hybrid learning, make education more flexible and provide students with access to learning materials regardless of their location. At the same time, digitalization requires teachers and students to develop new digital competencies and adapt teaching methods to modern learning environments [6].

European approaches also emphasize practice-oriented education. This means that theoretical knowledge should be connected with real professional tasks, case studies, laboratory work, internships, project-based learning and cooperation with industry. For engineering and technical specialties, practice-oriented learning is especially important because students must understand how academic knowledge is applied in production, environmental protection, resource management, occupational safety and technological innovation.

Lifelong learning is another important principle of higher education modernization. In modern society, professional knowledge and technologies change very quickly, so education cannot be limited to one period of life. Higher education institutions are expected to support continuous professional development, flexible learning paths, recognition of prior learning and opportunities for adults to update their competencies [7]. This approach is particularly relevant for specialists working in dynamic fields such as mining, environmental protection, digital technologies and natural resources management.

Sustainability has also become a major priority in European higher education. Universities are increasingly expected to contribute to sustainable development by integrating environmental, social and economic dimensions into teaching, research and institutional strategies. For technical universities, this means preparing specialists who understand the importance of resource efficiency, environmental responsibility, circular economy, climate awareness, occupational safety and responsible innovation [8].

In the context of eco-mining and innovative natural resources management, European approaches to higher education modernization are especially relevant. Future specialists must be able to combine engineering knowledge with environmental awareness, digital skills, risk assessment, resource management and sustainable decision-making. Therefore, educational programmes should include not only traditional technical disciplines, but also interdisciplinary components related to environmental protection, circular economy, waste management, water resource protection, occupational safety and innovation.

The Erasmus+ EMINReM project supports the implementation of these modernization approaches in partner higher education institutions in Ukraine, Kazakhstan and Uzbekistan. Through cooperation with European universities, curriculum development, academic mobility, updated teaching methods and digital educational tools, the project contributes to the training of specialists capable of addressing modern challenges in mining, environmental protection and natural resources management.

Thus, European approaches to higher education modernization are based on transparency, quality assurance, learning outcomes, student-centred education, academic mobility, digitalization, international cooperation and sustainability. Their implementation helps universities make educational programmes more flexible, relevant and practice-oriented, while preparing graduates for professional activity in an increasingly complex and international environment.

1.3. Higher Education Systems of Ukraine, Kazakhstan and Uzbekistan

Higher education systems of Ukraine, Kazakhstan and Uzbekistan have been undergoing modernization processes aimed at improving quality, transparency, international cooperation and the relevance of educational programmes to labour market needs. Although the three countries have different national contexts, they share several common priorities: development of multi-cycle higher education, implementation of credit-based learning, strengthening of quality assurance, support for academic mobility and modernization of technical and engineering education.

Table 2. Comparison of educational systems in Ukraine, Kazakhstan and Uzbekistan

Criterion	Ukraine	Kazakhstan	Uzbekistan
General orientation of higher education development	Ukraine's higher education system is oriented towards integration into the European Higher Education Area, implementation of Bologna Process principles, development of quality assurance mechanisms, academic mobility and international cooperation [9].	Kazakhstan has been a full member of the Bologna Process and the European Higher Education Area since 2010. Its higher education system is aligned with Bologna principles, including a multi-cycle structure, academic mobility, ECTS-based approaches and quality assurance [10].	Uzbekistan is not a member of the European Higher Education Area, but the country is actively modernizing higher education and introducing reforms aimed at improving quality, internationalization, credit-module learning and institutional development [11].
Main higher education cycles	The system includes Bachelor's, Master's and Doctoral levels.	The system includes Bachelor's, Master's and Doctoral levels.	Higher education is mainly organized through Bachelor's

	Higher education is structured according to the National Qualifications Framework and is generally compatible with the three-cycle model of the European Higher Education Area [9].	Kazakhstan applies a three-cycle structure of higher education in line with the Bologna Process parameters [10].	and Master's programmes, while postgraduate and doctoral training is provided through separate mechanisms of scientific and academic qualification development [11].
Credit system	Ukraine uses ECTS. A full academic year normally corresponds to 60 ECTS credits, and one ECTS credit usually equals 30 hours of student workload [12].	Kazakhstan applies an academic credit system compatible with Bologna Process approaches. ECTS-based mechanisms are used to support student workload, academic mobility and recognition of learning outcomes [10].	Uzbekistan has been introducing a credit-module system in higher education. This system is aimed at improving the organization of the educational process, strengthening student workload transparency and supporting compatibility with international educational practices [13].
Quality assurance	Quality assurance in Ukraine is connected with national legislation, institutional internal quality systems and external quality assurance procedures. It is also influenced by European approaches and the Standards and Guidelines for Quality Assurance in the European Higher Education Area [5], [9].	Quality assurance is one of the key areas of higher education modernization in Kazakhstan. The country develops external and internal quality assurance mechanisms and participates in Bologna-related processes, including recognition and international comparability of qualifications [10].	Uzbekistan is strengthening quality assurance as part of broader higher education reforms. Modernization measures include improvement of educational standards, institutional management, programme quality and international cooperation [11].
Academic mobility and internationali-zation	Academic mobility is an important part of Ukraine's higher education development and is supported through Erasmus+, bilateral agreements, international projects and recognition of	Academic mobility is one of the key priorities of Kazakhstan's Bologna-oriented higher education development. Student and staff mobility, Diploma Supplement, international	Uzbekistan actively develops international cooperation, participation in Erasmus+ projects, joint educational initiatives and academic exchanges. Internationalization

	learning outcomes obtained abroad [9].	cooperation and participation in global educational initiatives are important modernization directions [10].	is used as a tool for improving the quality and competitiveness of higher education [11].
Language and international cooperation	Ukrainian higher education institutions increasingly develop courses and programmes in foreign languages, especially English, to support mobility, international projects and cooperation with European partners.	Kazakhstan promotes internationalization, multilingual education and cooperation with foreign universities. English-language courses and international partnerships support integration into the global academic space [10].	Uzbekistan is expanding international cooperation and introducing reforms that support foreign language learning, international partnerships and modernization of educational content.
Technical and engineering education	Technical universities in Ukraine play an important role in training specialists for engineering, mining, environmental protection, digital technologies and industrial development. Modernization focuses on competence-based education, practical training and cooperation with industry.	Kazakhstan has strong traditions in technical, mining, engineering and industrial education. Higher education reforms support the preparation of specialists for the mining, metallurgical, energy and technological sectors.	Uzbekistan places significant emphasis on technical, engineering, mining, metallurgical and technological education, especially in connection with industrial development and natural resource sectors.
Relevance to EMINReM	For Ukraine, the EMINReM project supports modernization of educational components in eco-mining, environmental protection, natural resources management, academic mobility and implementation of EU-based teaching methods.	For Kazakhstan, EMINReM contributes to the development of eco-mining education, international cooperation, curriculum modernization and strengthening of practical and research-oriented training in mining and natural resources management.	For Uzbekistan, EMINReM supports the modernization of technical and mining-related education, development of credit-based and competence-based approaches, academic mobility and cooperation with European universities.

Despite national differences, the higher education systems of Ukraine, Kazakhstan and Uzbekistan are moving towards

greater transparency, international cooperation and compatibility with global educational standards. For the EMINReM project, this creates a common basis for curriculum modernization, academic mobility, recognition of learning outcomes and the introduction of innovative teaching methods in eco-mining and natural resources management education.

2. EUROPEAN CREDIT TRANSFER SYSTEM – ECTS

2.1. ECTS and history of its development

The history of ECTS, 1989–2019 celebrated the 30th anniversary of the European credit system for higher education. The development of ECTS had to start from scratch because worldwide there was no experience in setting up and running a national and/or international student workload-based transfer system that applied credit points. A Pilot Scheme (1989-1995) was set up to define ECTS. It involved five subject areas, and 145 HEIs in total, and set out to develop a sustainable, robust and reliable tool to facilitate international student mobility.

Based on the notions of trust and confidence and the concept of 'relative' student workload, it was unique. It opted for 60 credit points to represent one academic year [14].

At the initial stage, ECTS performed the functions of the transfer system. Its main task was to serve as a bridge for the connection of various educational systems and structures in Europe. At the same time, ECTS provided all three main aspects of the transfer: transfer of educational content; transfer of educational activities volume; transfer of evaluation results.

In the framework of the Erasmus program, student mobility was implemented on the basis of Bilateral Agreements between universities and departments, which were usually based on pre-established scientific and educational contacts. This meant that when a student was sent to study at another university abroad, his home institution had enough complete information about the content of academic disciplines that the student studied abroad, learning technologies, assessment culture, etc.

It can be assumed that at that time ECTS (often called ECTS 1) was mainly a tool for organizing international mobility, formalization of relevant procedures, provided certain guarantees for both the student and for both universities. Significant advantages of ECTS were its simplicity and versatility at both national and international levels [15].

Around 2000 it was concluded that ECTS in its present form was no longer sustainable and that action was required. There were concerns about a lack of flexibility and the level of recognition. It was thought necessary to transform the European

Credit Transfer System into a European Credit Transfer and Accumulation System (ECTS 2) in the framework of the Tuning Project. This implied an adjustment of the ECTS principles: not only student workload but also the outcomes of the learning process should be decisive for awarding credit points.

This linked ECTS to the paradigm change that was embraced in 2009 by the Bologna Process: from the expertise-driven approach to the so-called student-centered approach - that is to make what students need to operate successfully in society after graduation the focal point of educational programs.

Today, the use of ECTS credit points in higher education in Europe is routinely perceived as a day-to-day reality. Its underpinning concept – workload – has also been picked-up in other world regions. ECTS is:

a system of both transfer and accumulation of credits;

the basis for educational programs development and implementation;

a tool for comparing academic achievements in different countries and in different aspects of formal and non-formal learning, etc. [15].

Time history of ECTS transformations are indicated in the table “ECTS Key Features over time”.

At present, nearly all of the 48 signatory of the Bologna Declaration are convinced that ECTS is a key instrument for student-centered reform of higher education programs [14].

ECTS Key Features over time

	ECTS definition
1990	ECTS, the European Community Course Credit Transfer System, is based on the principle of mutual trust and confidence between participating HEIs. The few rules of ECTS, concerning Information (on courses available), Agreement (between the home and the host institutions) and the Use of Credit Points (to indicate student workload) are set to reinforce mutual trust and confidence. Each department describes the courses it offers not only in terms of content but also adding the indication of credits to each course
1995/1998	ECTS provides an instrument to create transparency, to build bridges between institutions and to widen the choices available to students. The system makes it easier for institutions to recognize the learning achievements of students through the use of commonly understood measures – credits and grades – and it also provides a means to interpret national systems of higher education. The ECTS system is based on three core elements: information (on curriculum programs and students' achievement), mutual agreement (between the partner institutions and the student), use of ECTS credits (to indicate student workload)

2004	The ECTS is a student-centered system based on the student workload required to achieve the objectives of a program, objectives preferably specified in terms of the learning outcomes (LO) and competences to be acquired
2009	ECTS is a learner-centered system for credit accumulation and transfer based on the transparency of LO and learning processes. It aims to facilitate planning, delivery, evaluation, recognition and validation of qualifications and units of learning as well as student mobility. ECTS is widely used in formal higher education and can be applied to other LLL activities
2015	ECTS is a learner-centered system for credit accumulation and transfer, based on the principle of transparency of the learning, teaching and assessment processes. Its objective is to facilitate the planning, delivery and evaluation of study programs and student mobility by recognizing learning achievements and qualifications and periods of learning
ECTS credits	
1990	The workload − 60 credits per year of study; 30 credits/semester and 20 credits/term. It is important that no special courses be set up for ECTS purposes, but all ECTS courses be mainstream courses of the participating institutions, as followed by home students under normal regulations
1995/1998	The workload − 60 credits per academic year; 30 credits/semester and 20 credits/term
2004	ECTS is based on the principle that 60 credits measure the workload of a fulltime student during one academic year. The student workload of a fulltime study program in Europe − around 1500–1800 hours/year; one credit − 25-30 working hours
2009	60 ECTS credits are attached to the workload of a full-time year of formal learning (academic year) and the associated LO. The student workload –1500–1800 hours/academic year; one credit corresponds to 25-30 working hours
2015	ECTS credits express the volume of learning based on the defined LO and their associated workload. 60 ECTS credits are allocated to the LO and associated workload of a full-time academic year or its equivalent, which normally comprises a number of educational components to which credits are allocated. ECTS credits are generally expressed in whole numbers
Learning outcomes (LO)	

2004	Credits can only be obtained after successful completion of the work required and appropriate assessment of the LO achieved. LO are sets of competences, expressing what the student will know, understand or be able to do after completion of a process of learning, long or short
2009	ECTS credits are based on the workload students need in order to achieve expected LO. LO describe what a learner is expected to know, understand and be able to do after successful study completion. They relate to level descriptors in NQF and EQF
2015	LO are statements of what the individual knows, understands and is able to do on a learning process completion. The achievement of LO has to be assessed through procedures based on clear and transparent criteria. LO are attributed to individual educational components and to programs at a whole. They are also used in EQF and NQF to describe the level of the individual qualification
Workload	
1990	ECTS credits are a value allocated to course units to describe the students' workload required to complete them. They reflect the quantity of work each course requires in relation to the total quantity of work required to complete a full academic year at the institution: that is, lectures, practical work, seminars, individual work, examinations and other assessment activities. ECTS credits express a relative value, with respect to one year's total workload
1995/1998	ECTS credits are a relative rather than an absolute measure of student workload. They only specify how much of a year's workload a course unit represents at the institution or department allocating the credits
2004	Student workload consists of the time required to complete all planned learning activities (attending lectures, seminars, independent and individual study, preparation of projects, examinations, etc.)
2009	Workload indicates the time students typically need to complete all learning activities (lectures, seminars, projects, practical work, self-study, examinations) required to achieve the expected LO
2015	Workload is an estimation of the time the individual typically needs to complete all learning activities required to achieve the defined LO in formal learning environments. The correspondence of the academic year full-time workload to 60 credits is often formalized by national legal provisions. It should be recognized that the typical workload and that for individual students the actual time to achieve the LO will vary
Allocation of credits	
1990	It is up to the participating institutions to subdivide the credits for the different courses. Practical placements and optional courses, which form an integral part of the study courses also receive academic credit. Non-credit courses may, however, be mentioned in the Transcript of Records

1995/1998	ECTS credits are a numerical value (between 1 and 60) allocated to course units to describe the student workload required to complete them. They reflect the quantity of work necessary to complete a full year of academic study at the institution (lectures, practical work, seminars, tutorials, fieldwork, private study, examinations or other assessment activities). ECTS is thus based on a full student workload and not limited to contact hours only
2004	Credits are allocated to all educational components of a study program (such as modules, courses, placements, dissertation work, etc.) and reflect the quantity of work each component requires to achieve its specific objectives or LO in relation to the total quantity of work necessary to complete a full year of study successfully
2009	Credits are allocated to entire qualifications or study programs as well as to their educational components (modules, course units, dissertation work, work placements and laboratory work). The number of credits ascribed to each component is based on its weight in terms of the workload students need in order to achieve the LO in a formal context
2015	Allocation of credits is the process of assigning a number of credits to qualifications, degree programs or single educational components. Credits are allocated to entire qualifications or programs according to national legislation or practice, where appropriate, and with reference to NQF and/or EQF. They are allocated to educational components (course units, dissertations, work-based learning and work placements), taking as a basis the allocation of 60 credits per full-time academic year, according to the estimated workload required to achieve the defined LO for each component
Awarding of credits	
1990	Credits are awarded only when the courses have been completed and all the required examinations have been successfully taken
1995/1998	ECTS credits are allocated to course units but are only awarded to students who successfully complete the course by satisfying the assessment requirements. In other words students do not get credits simply for attending classes or spending time abroad – they must satisfy the assessment regulations specified at the host institution to demonstrate that they fulfilled the stated learning objectives for the course unit. The assessment procedure may take various forms: written or oral examinations, coursework, a combination of the two or other means such as presentations at seminars, information on which should be included in the information package
2004	(See Learning outcomes)
2009	Credits are awarded to individual students (full-time or part-time) after completion of the learning activities required by a formal program of study or by a single educational component and the successful assessment of the achieved LO

2015	Awarding credits in ECTS is the act of formally granting students and other learners the credits that are assigned to the qualification and/or its components if they achieve the defined LO. National authorities should indicate which institutions have the right to award ECTS credits. Credits are awarded to individual students after they have completed the required learning activities and achieved the defined LO, as evidenced by appropriate assessment. If students and other learners have achieved LO in other formal, non-formal, or informal learning contexts or timeframes, credits may be awarded through assessment and recognition of these LO

Transfer of credits	
1990	The students participating in ECTS will receive full credit for all academic work successfully carried out at any of the ECTS partner institutions and they will be able to transfer these academic credits from one participating institution to another on the basis of prior agreement on the content of study programs abroad between students and the institutions involved. When the student has successfully completed the study program previously agreed between the home and the host institutions, and returns to the home institution, credit transfer will then take place, and the student will continue the study course of his/her home institution without any loss of time or credit. If, on the other hand, the student decides to stay at the host institution and to take the degree there, he/she may have to adapt his/her study course due to the legal, institutional and departmental rules in the host country, institution and department
1995/1998	Home and host institutions prepare and exchange transcripts of records for each student participating in ECTS before and after the period of study abroad. A copy of these transcripts is given to the student for his/her personal file. The home institution recognizes the amount of credits received by their students form partner institutions abroad in respect of specific course units such that the credits for the course unit passed replace the credits which would otherwise have been obtained from the home institution. Thus full academic recognition is given
2009	Credits awarded in one program may be transferred into another program, offered by the same or another institution. This transfer can only take place if the degree-awarding institution recognizes the credits and the associated LO. Partner institutions should agree in advance on the recognition of periods of study abroad
2015	Transfer of credits is the process of having credits awarded in one context (program, institution) recognized in another formal context for the purpose of obtaining a qualification. Credits awarded to students in one program may be transferred from an institution to be accumulated in another program offered by the same or another institution. Credit transfer is the key to successful study mobility. Institutions, faculties, departments may make agreements which guarantee automatic recognition and transfer of credits.

Accumulation of credits	
2009	Credits may be accumulated with a view to obtaining qualifications, as decided by the degree-awarding institution. If students have achieved LO in other learning contexts or timeframes (formal, non-formal or informal), the associated credits may be awarded after successful assessment, validation or recognition of these LO
2015	Accumulation of credits in ECTS is the process of collecting credits awarded for achieving the LO of educational components in formal contexts and for other learning activities carried out in informal and non-formal contexts. A student can accumulate credits in order to: – obtain qualifications, as required by the degree-awarding institution; – document personal achievements for LLL purposes
ECTS documentation	
2015	The use of ECTS credits is facilitated and quality enhanced by the supporting documents (Course Catalogue, Learning Agreement, Transcript of Records, and Work Placement Certificate). ECTS also contributes to transparency in other documents such as the DS

2.2. The ECTS Course Catalogue content and assignment

Three key ECTS elements (Information, Agreement and the Use of Credit Points) are implemented by addressing to the following main documents:

– Course Catalogue is a document containing the HEI curriculum descriptions in two languages, national and English (or only in English for programs taught in this language), posted on the Internet and/or published in hard copy;

– Learning Agreement (LA) contains a list of disciplines to be studied by the student, agreed with the responsible HEI department. If there is any need in credits transfer, the LA should be agreed with both old and new institutions before the student transfer to another HEI and must be updated as changes occur;

– Transcript of Records reflects the student's success in the disciplines studied, credits, local grades (according to national tradition or regulations of the HEI) and ECTS grades received. When the need of credits transfer arises, the Transcript of Records is issued by the home institution before the outgoing student leave, and by the host institution at the end of his/her period of study.

The ECTS Course Catalogue is one of the supporting documents of the European Credit Transfer (and Accumulation)

System (ECTS). According to the ECTS Users' Guide, the ECTS Course Catalogue should include "detailed, user-friendly and up-to-date information on the institution's learning environment that should be available to students before entering and throughout their studies to enable them to make the right choices and use their time most efficiently" [16].

The ECTS Course Catalogue has always played an important role in the Erasmus program. However, the importance of the ECTS Course Catalogue is not limited to international mobility in the framework of Erasmus+. Providing insight into an institution's educational programs and teaching and learning environment is also important for (international) recruitment in general and for collaboration with other HEIs and with stakeholders in the world of work.

To emphasize the importance of the ECTS Course Catalogue, the ECTS label was introduced in 2009. Institutions that could demonstrate that they had an ECTS Course Catalogue that complied with the guidelines in the ECTS Users' Guide could apply for and be awarded the ECTS label. When the Erasmus+ program was launched in 2014, the ECTS Course Catalogue received a prominent place in the Erasmus Charter for Higher Education (ECHE). By signing the ECHE, HEIs agree to comply with the requirements regarding the ECTS Course Catalogue.

Some general instructions from the ECTS Users' Guide:

– the Course Catalogue should be published on the institution's website. It is advisable to make sure that the ECTS Course Catalogue is accessible for all visitors of the institution's website and is not 'hidden' on the institution's intranet and only accessible for those with a password;

– the Course Catalogue should be published sufficiently in advance for prospective students to make their choices;

– the general information about an institution and the information about study programs and individual educational components should be available in a widely-spoken language (e.g. English) and the language of instruction as an ECTS Course Catalogue is not only aimed at (prospective) students, but at a much wider audience, including employers, colleagues in other institutions and partner institutions, and other stakeholders;

– the institution is free to decide the format of the Catalogue, as well as the sequencing of the information. However, a common structure introduced in the ECTS Users' Guide [16]

makes Course Catalogues more easily comparable and improves transparency. In any case, the Course Catalogue should include the general information on the institution, its resources and services, as well as academic information on its programs and individual educational components.

1. General information

The general information on the institution will, in most cases, be published on the institution's website with the listed information placed, depending on the structure of the institution's website [17].

General information	
Name and address	Name in the national language. If the HEI has a name in English, this name should also be given. List of campuses and addresses at which the HEI is established
Description of the institution (including type and status)	Any general description of the institution should clearly mention the type of HEI, especially in the case of a binary system
Academic authorities	Provide information on the HEI governance structure, including the names and positions of the Executive Board members
Academic calendar	Start and end of the academic year (specify per year, if these dates vary over the years) and main holidays
List of programs offered	Provide a comprehensive survey of the faculties/departments and the degree programs (BSc, MSc, PhD) that are offered. The names of the degree programs should be available in English and in the language of instruction
Admission requirements, including language policy, and registration procedures	This information may be given at an institutional level and/or at the level of individual programs. Make sure that it is clear whether the information applies to fee-paying students (national and/or international) or to exchange student
Arrangements for the recognition of credit mobility and prior learning (formal, informal and non-formal)	Describe the procedure for the credits recognition that students have earned during a mobility period abroad (for study or traineeship). Also describe the institution's policy on the prior learning recognition
ECTS credit allocation policy (institutional credit framework)	Describe how ECTS credits have been allocated to the programs. If there is an institutional or national policy with regard to the number of hours workload that represent 1 ECTS credit, provide this information
Arrangements for academic guidance	Describe what types of academic guidance are available
Resources and services	
Student affairs office	The information on these topics is relevant for both national and
Accommodation/housing	

Meals	international students and for both fee-paying and exchange students. Depending on the target group, the nature of the information may differ. Make sure that it is unambiguous to whom the information applies
Cost of living	
Financial support for students	
Medical facilities	
Insurance	
Facilities for students with disabilities and special needs	
Learning facilities	
International mobility possibilities	
Practical information for incoming mobile students	
Language courses	
Work placement possibilities	
Sports and leisure facilities	
Student associations	

2. Information on programs

A complete ECTS Course Catalogue provides information on all degree programs that are offered by the HEI, so not only programs that are open to international students (fee-paying and/or exchange). The information should be available in English and the language of instruction.

Make sure the information detailed below tallies with the information on the Diploma Supplement that is issued to students who complete the program [17].

Qualification awarded, length of program, number of credits	Be specific about the type of qualification, e.g. Bachelor of Arts, or Bachelor of Nursing. Give the length of the program in years or in months. Give the total number of ECTS credits for the program
Level of qualification according to the NQF and the EQF	E.g. BSc degree; EQF for LLL: level 6; NQF: level 6
Field(s) of study	The International Standard Classification of Education (ISCED) was developed by UNESCO to facilitate comparisons of education statistics and indicators across countries on the basis of uniform and internationally agreed definitions
Specific admission requirements (if applicable)	This information may be given at an institutional level and/or at the level of individual programs. Make sure that it is clear whether the information applies to fee-paying students (national and/or international) or to exchange students
Specific arrangements for recognition of prior learning (formal, non-formal and informal) (if applicable)	
Qualification requirements and regulations, including graduation requirements (if applicable)	Normally, students will receive a diploma when they have completed the (official) study program and have obtained the required number of credits. If there are any other specific requirements that students need to have fulfilled, mention them here
Profile of the program	It could be argued that the collective information in this section is a program profile. However, it is important that

	the ECTS Course Catalogue includes a brief description of the main focus of the program
Program learning outcomes	List the LO at program level. It is advisable to limit the number of LO to approximately 20. It is also advisable to make sure that the program LO in the course catalogue correspond with those on the Diploma Supplement
Program structure diagram with credits (60 ECTS credits per full time equivalent academic year)	Provide an overview of the structure of the entire program. This can be done with a diagram, but other forms of presentation are also possible. It should be made clear whether a program is based on e.g. semesters or trimesters. In some HEIs, a semester is divided into two periods of around 10 weeks
Mode of study	Indicate whether the program is e.g. full-time, part-time, dual, e-learning
Examination regulations and grading scale	The examination regulations should be accessible, although most HEIs will not choose to give this type of information a very prominent place on the website, since the information tends to be very detailed. Provide information on the grading system used at national and/or institutional level. If the institution/program does not use the ECTS grading table, provide information on how the transfer of grades awarded by partner HEIs is done
Obligatory or optional mobility windows (if applicable)	Provide information on whether students have the option or are obliged to do part of their study program outside of the institution. The term mobility window generally refers to a study period or work placement abroad
Work placement(s) (if applicable)	Provide information on whether the program provide information on whether students have the option/are obliged to do part of their study program outside of the HEI. The term mobility window generally refers to a study period or work placement abroad contains work a placement(s) (internships; traineeships) and whether these are obligatory or optional parts of the program. Include the number of credits for (each of) the work placement(s)
Work-based learning (if applicable)	If the program contains a form of work-based learning other than a (traditional) work placement, give a brief description
Program director or equivalent	It may be an institution's policy not to provide names and contact details of individual members of staff on the institution's website. In that case, general contact details should be provided
Occupational profiles of graduates	Give a brief description of the types of jobs for which the program prepares students and/or that graduates generally fulfil
Access to further studies	Describe what types of further study (e.g. Master or PhD programs) are accessible for graduates

3. For joint programs (additional information)

Information on the form of the diploma and DS (joint/double/multiple)	A joint program may lead to different types of degrees. Joint degrees can only be awarded by a consortium of two or more HEIs. Joint program more often lead to a double or multiple degree; in this

	case, each of the participating HEIs awards their own degree
Members of consortium and their role	List the HEIs which form the consortium that is responsible for offering the program and, in the case of a joint degree, are responsible for issuing the diploma
Mobility structure of the program	Joint programs generally involve a mandatory mobility period at (one of) the partner HEIs that offer the joint program. Provide information on which parts of the program the student has to do abroad, including the number of ECTS credits

4. Information on individual educational components

The information on the individual educational components that make up a study program is what is often understood to be the 'real' course catalogue. It is important to provide a clear link between the information about a program and the information about the individual educational components that are part of a program.

As with the information at program level: the information should be available in English and the language of instruction [17].

Code	Code that is assigned to the component in the institution's student administration system
Title	Make sure that the English translation of the individual educational component name tallies with the names listed on the Transcript of Records (which is part of the DS)
Type (compulsory/optional) and cycle (short/first/second/third)	Cycle refers to B/M/Doctorate. It may not be necessary to provide this information for every individual educational component, as long as it is clear which program the component is part of
Year of study when the component is delivered (if applicable)	Indicate in which year students normally complete this component
Semester/trimester when the component is delivered	Indicate whether the component if (only) offered in the first or second semester of the academic year, or in both
Number of ECTS credits allocated	Give the number of ECTS credits that has been allocated to this component
Learning outcomes	Provide a list of the LO for this component
Name of lecturers	Provide information on the lecturers that are responsible for teaching this component. It may be an institution's policy not to provide names and contact details of individual members of staff on the institution's website. In that case, general contact details should be provided
Mode of delivery	Provide information on the mode of the component delivery, e.g. via e-learning, face-to-face, etc.
Prerequisites and co-requisites (if applicable)	Provide information on whether a student must have successfully completed certain courses before s/he can take this course

Course content	Provide a brief description of the course content. This information bears a close link to the LO of the component, but has a different function
Recommended or required reading and other learning resources/tools	Provide a list of the (most important) literature that students are required/recommended to read, but also include other learning resources. The information is not only relevant for students, but also for partners, in that it indicates the main focus and the approach that is used
Planned learning activities and teaching methods	List the most important modes of delivery for this component, e.g. lectures, group work, seminars, tutorials, etc.
Assessment methods and criteria	Provide information on how this component will be assessed, e.g. by means of a written or oral exam, a report, a presentation, a project, group work assessment
Language of instruction	Indicate in which language(s) the component is taught. If the component is taught in the domestic language, but may include guest lectures given by international guest lecturers or group work with international groups of students, it is relevant to mention that the language of instruction can also be English.

2.3. The estimation procedure and evaluation system analysis

Student assessment is the most important component of the higher education process. Student activities in mastering LO planned in ACWP.

Learning outcomes are what a student knows, understands and is able to perform after completing the learning process. The level of student LO achievement is assessed during estimation activities.

Considering the current regulatory framework for students` scholarships, clear and detailed certification of their academic achievements becomes paramount. It should be carried out through transparent procedures based on objective criteria.

Assessment criteria is a description of what a student should do to demonstrate the LO achievement. The criteria content should be based on the competency characteristics defined for each higher education level by the NQF [18].

Grading scales

Due to the new European approach to grades conversion [9] and the official absence of a national grading scale, HEIs have been given the right to introduce institutional grading scales.

The most common scales for student learning outcomes assessment in most universities in Ukraine

Rating	Conversions
90–100	Excellent
75–89	Good
60–74	Satisfactory
0–59	Fail

Purpose of evaluation

Student LO assessment is carried out on a 100-point scale. Grades above 60 points are considered positive and are used for:

1. Transfer of credits for each component (credit module) of the educational process plan in accordance with the summative assessment results.

2. Determining the rating score of the quality of training in order to analyze the graduates LO for compliance with the conditions of degree with honours awarding.

The degree with honours is issued if at least 75 % of all credit modules (disciplines, practices, course projects, etc.) have grades of at least 90 (excellent), and the rest - at least 75 points (good), as well as if the student has defended a Qualifying Paper/passed Certification Exams with a grade of not less than 90 (excellent).

3. Determining the student's rating score when considering the academic scholarship granting.

4. Grades conversion based on evaluation tables of two reference groups with different national evaluation systems.

5. Professional qualification awarding. Criteria for awarding: all credit modules have grades of at least 75 points (good), Practical Training results estimation and Qualifying Paper defence - at least 75 points (good).

Diagnostic tools

Course modules	1. Generalized diagnostic tools. According to HEIs Standards, academic course working program for each credit module should contain generalized diagnostic tools developed on the basis of program LO according to higher education standards. 2. Specified diagnostic tools are directly applicable to control measures. They are formed on the basis of generalized diagnostic tools by specifying the initial data and the way of LO demonstrating. Comprehensive Module Test (CMT) should contain specific tasks that cover key LO. The number of specified tasks of the CMT should be adapted to the allotted completion time. The number of CMT options should provide the task individualization. The number of papers for the oral exam must exceed the number of students in the academic group by at least five

Term papers		Term paper is an individual task, the implementation of which in accordance with the educational program refers to the design-construction competencies of the specialist. This type of training may include elements of the technical task, sketch and technical projects, working, operational, repair documentation development, design justification of technical solutions, etc. Term papers execution is regulated by the relevant standards. Term papers are performed in order to consolidate, deepen and generalize the knowledge acquired by students during their studies, their application for a comprehensive solution of a specific professional task. This form of educational work is used at the final stage of curriculum learning. The project topic should be clear in terms of the final product to be obtained. Term papers subject is developed by the corresponding department, tasks for students - by the teacher-supervisor. Student also have the right to propose the term paper topic/ source data/decision-making methods according their own areas of expertise in order to avoid making stereotypical decisions and to promote analytical skills development. The implementation of comprehensive interdisciplinary projects is welcome. Requirements for drawings, software, structure and content of paper are described in the Term paper guidelines. The term paper is performed by the student independently under the teacher`s supervision.
Practical Trainings		Report on the Practical Training and the individual task implementation is the object of the Practical Training results evaluation. The report consists of two parts. The general part covers the following issues: – information about the enterprise (Practical Training base) nature of business; – structure of the Practical Training base; – generalized characteristics of the production process (algorithm and technological operations description, organization and management system components); – professional responsibilities of specialists with higher education, aimed at the technological process organization, implementation and management. The second part of the report should reflect the results of the individual practical task. It should contain a description and evaluation of the practical solution. This approach activates students, expands their worldview and creates conditions for initiatives` implementation. The report is reviewed and approved by the Head of the enterprise and checked by the supervisor from the HEI.
Qualification Examination	Qualifying Paper	Qualifying Paper (degree project, degree work) is performed by the student at the final stage of professional training. It assesses the level student professional competencies formation. Degree Project devoted to solving production tasks, the vast majority of which are referred to design-constructing in the higher education standards in accordance with professional functions. Execution of the technical task, sketch and technical projects, working, operational, repair documentation, etc. is provided. The Degree Project includes a set of sketches (graphical part) and explanatory note. Degree Work is devoted to solving production problems in the technological process organization (technical training, maintenance, control) and management (planning, accounting, analysis, regulation). Degree Work includes demonstration material (reflecting original practical results) for the report to the examination board and an explanatory note.

	Certification Exam	The Certification Exam is carried out according to the Complex Qualifying Tasks (CQT). The content of the CQT submitted for the Certification Exam is focused on: – for BSc – on the diagnosis of the level of theoretical knowledge and practical skills sufficient for the successful performance of professional duties according to the specialty (specialization); – for MSc - on the diagnosis of the level of theoretical knowledge, skills, abilities in the chosen specialty (or specialization), general principles of scientific and/or professional activity techniques, other competencies sufficient for effective innovative tasks implementation in professional activity.

Evaluation criteria

The student's LO, reflecting the achieved level of competencies relative to the expected ones, are identified and measured during the estimation activities through certain criteria application.

Complex and time-consuming tasks (tests, CMT, Term/ Qualifying Papers, Practical Trainings, Certification Exams etc.) are assessed expertly using criteria characterizing the ratio of requirements to the level of competencies and assessment indicators on a rating scale.

Requirements to LO (knowledge, skills, communication, autonomy and responsibility) to ensure a cross-cutting approach must be correlated with the descriptors (competencies description) of the NQF [18].

Course modules	Formative assessment should be carried out during all types of classroom training. Its purpose is to determine the disciplinary LO achievement level on a particular course unit, practical classes (tests, individual tasks checking and defense), laboratory works (checking and defense), seminars (reports presentation, participation in discussions). The summative assessment (grading test, exam) purpose is a comprehensive assessment of the LO formation level in the curricula for the quarter, semester, academic year. Grading tests are carried out on the formative assessment results basis. The summative assessment results for the semester are used as a criterion of curriculum mastering by the student. The summative assessment form is indicated in the ACWP. The content and structure of exam papers and evaluation criteria are determined by the Department decision. An individual schedule of the summative assessment can be set for individual students if there are documented clear reasons.

Term papers	The final quality assessment of term papers is carried out before the examination session according to the department consultations schedule. Term papers assessment is carried out in accordance with the general criteria set out in the NQF descriptors
Practical Trainings	The final assessment of the Practical Training results is carried out before the examination session according to the department consultations schedule. The Practical Training results evaluation is carried out expertly. The grade for the Practical Training is calculated as the average score based on the results of the report`s general part, the individual task and taking into account the reference of the head of the Practical Training base.
Qualification Examination	Attestation of persons who obtain the degree of junior bachelor, BSc or MSc is carried out by the examination board in accordance with the regulations on the examination board approved by the Academic Council. Qualifying Paper must be checked for plagiarism and published on the official website of the university or its department, or in the repository. MSc' certification may be carried out in the form of a Certification Exam in the specialties and in the manner prescribed by the Cabinet of Ministers of Ukraine. The HEI awards the person, who has successfully completed the educational program, the appropriate higher education degree and assigns the appropriate qualification on the basis of the examination board decision.

Estimation procedure

According to ECTS [16], assessment includes the full range of written, oral, practical control procedures depending on the competence characteristics (knowledge, skills, communication, autonomy and responsibility) of LO, the achievement of which is monitored.

Measurement of the LO achievement level is carried out by the mastering coefficient or expertly according to the criteria correlating with the NQF descriptors.

Liquidation of unfulfilled program requirements

Course modules	Re-completion of the course summative assessment, when the student received a grade "fail" (below 60 points), is allowed no more than twice. Student attempts to correct the grade and prevent unfulfilled program requirements are limited to one month after the examination session end. The first re-examination is administered by the relevant course teacher, the second – by the commission consisting of three persons: the course teacher; the head of the department; a representative of the dean's office or the relevant department teacher. The decision of the commission is final. If the commission confirms the grade "fail" or if the student does not appear at the commission meeting without a clear reason, the commission notifies the dean of the faculty. Thereafter, an enrolment termination order for student`s academic failures is issued or the conditions for the course re-study are determined by the HEI rector.
Term papers	Liquidation of unfulfilled program requirements on term papers is carried out similarly to the procedure of unfulfilled program requirements liquidation on course modules.

Practical Trainings	A student who did not complete the practical training program without clear reasons and received a negative reference from the enterprise or a grade “fail” is expelled from the HEI.
Qualification Examination	The Qualifying Paper re-defense or the Certification Exam re-passing in order to increase the grade is not allowed. If the student failed in the Certification Exam passing/Qualifying Paper defense, he/she is expelled from the HEI and an academic certificate of a standard form is issued. In this case, the examination board determines whether the student can submit the same Qualifying Paper to the defense (with the modifications, which is determined by the commission) or must develop a new topic (which is assigned by the relevant department). A student who has not defended the Qualifying Paper is allowed to re-defend it within three years after graduation from the HEI. If a student was admitted to the Qualification Examination, but for a clear documented reason could not pass it in time, the First vice-rector determines the date of an additional examination board meeting during it`s working period. For students not admitted to the Examination having clear documented reasons not to be prepared for it, the Rector at the request of the Dean of the Faculty extends the Learning Agreement term until the next examination session, but not more than one year.

Evaluation system analysis

National Evaluation Systems vary from country to country. Almost all of them are based on indicators, that is, students are assessed by comparing their achievements with certain criteria and standards of LO that do not depend on the composition or volume of the assessed student body. Some HEIs and Public Authorities provide detailed and accurate samples indicating the knowledge level, which a student needs to obtain a particular grade.

There are a few exceptions to the general Rule of Indicator Assessment. For example, Spanish HEIs now use a normalizing system for the highest degree awarding, and according to the “Matricula de Honor” law, no more than 5 % of students can receive it. The normalizing principles, underlying the ICTS, do not comport well with the fact that the Indicator Assessment Systems are most often used in European HEIs [20].

Universities in all EU countries except Sweden use numerical evaluation systems in combination with grade descriptions. Often the Systems used in one country differ significantly from each other. For example, Finish HEIs use two evaluation scales – from 5 to 3 (the highest grade) to 1+ (the lowest grade); Danish HEIs – from 13 (the highest) to 6 (the lowest), while there is no grade of 12; Italian – from 30+ to 18 points. Most evaluation scales are bottom-up (the higher the point, the higher the final grade).

There are also exceptions – Austria, Germany, Czech Republic, Ireland, Malta and Great Britain (although at the latter three countries Evaluation System based on rising percentages is used). In general, there is no definite dominant System in the European Union [11].

Most scales are asymmetric with respect to a passing grade. For example, there are only 2 or 3 passing grades in Sweden and the Czech Republic, while in Germany – up to 11. However, there is a separate category assigned to outstanding academic results in all Evaluation Systems. So, in the Flemish part of Belgium, students with a maximum (20) points acquired receive the degree "With Honours/the highest outstanding scores and congratulations from the Examination Board" [Met de grootste onderscheiding met felicitaties van de Examencommissie]. However, this degree is awarded differently. In Latvia, the evaluation scale includes points from 1 to 10, but the maximum grades are 8 – "very good" [Ļoti Labi], 9 – "excellent" [Teicami] and 10 – "with honors" [Izcili]. The highest grade is received only by the very best students, whose knowledge significantly exceeds the expected level from this course (for instance, if a student demonstrates familiarity with additional scientific literature or participates in additional research activities). Similarly, in Italy the maximum score is 30 points [con lode/cum laude] and in exceptional cases – [con lode e pubblicazione] – with thesis publication.

Most countries (except Greece and Sweden) have a minimum required passing grade – "fair" or "sufficient". In all countries' Systems, there are intermediate grades between the minimum and maximum grades – "good" and "very good". However, the grades awarded to most students are understood and used differently in some countries. In some (e.g. Germany, Latvia, Lithuania, the Netherlands and Poland) more than one passing grade is used, in others "good" and "very good" grades are split into smaller gradations.

The problem of calculating the percentage equivalent of various grades also exists. Converting to percentages allows estimate the range of these individual categories. As expected, in many cases (with rare exceptions) it is found that the higher the grade, the smaller its range. With minor discrepancies, passing grades hover around 50 %, i.e. from 48 to 51 %. Such estimations are used in more than half of the EU countries. In

most countries, there is only one failing grade ("fail", "insufficient", "failure", "failing", "poor") [21].

Not all universities provided information on the number of re-examinations allowed and how much of the re-examination grade is taken into account. However, the existing evidence suggests a variety of practices. In Italy, students can decide whether to accept the grade or to retake an exam, even if they have been assigned passing grades. The re-examination can be completed once, sometimes more times. In Denmark, students are given 3 attempts (in exceptional cases – 4; a special permission of the Ministry may be issued in case of the 5th attempt). At the same time, unsuccessful attempts are recorded in the student record book but are not taken into account when calculating the final grade. Finland, Germany and Latvia do not have uniform state rules governing the re-examination; HEIs develop their own procedures. As a rule, students are allowed to retake.

Almost in all systems, the grade obtained during the re-examination is fully credited without reducing the overall grade.

Thus, the creation of a new common European Evaluation System would benefit the European integration in the field of higher education. Ideally, it should be based on indicators that will be compared with a certain level of academic achievement; it should contain five or more passing grades, one of which will only be awarded to the very best students; provide various well-defined categories for average and good students (currently being the majority). A passing grade must be 5 out of 10 or 10 out of 20; there must be another "sufficient" grade above the passing grade. Students must also be eligible for at least two re-examination attempts without reducing the overall grade [21].

3. INTERNATIONAL ACADEMIC MOBILITY AND RECOGNITION

3.1. Organization of Academic Mobility

Academic mobility is one of the key instruments of internationalization in higher education. It allows students, academic staff, researchers and administrative staff to study, teach, train, conduct research or participate in professional development activities at a partner institution abroad. In the European Higher Education Area, academic mobility is closely connected with the principles of transparency, recognition of learning outcomes, quality assurance and cooperation between higher education institutions [1], [4], [16].

Within Erasmus+ and other international educational projects, academic mobility is not an isolated activity, but a structured process that requires careful planning, institutional agreements, transparent selection, academic preparation, monitoring and recognition of results. Proper organization of mobility ensures that the period spent abroad contributes to the participant's academic, professional and personal development and is fully integrated into the educational process at the home institution [22].

The organization of academic mobility usually includes three main stages: preparation before the mobility, implementation during the mobility and follow-up after the mobility. Each stage involves specific procedures and responsibilities for the sending institution, the receiving institution and the participant.

The preparation stage begins with the establishment of cooperation between partner institutions. In Erasmus+ mobility, the sending and receiving higher education institutions must have an inter-institutional agreement, which defines the framework for cooperation, mobility areas, number of participants, responsibilities of the parties and general quality requirements [27]. Higher education institutions from EU Member States and third countries associated to the Erasmus+ Programme must hold the Erasmus Charter for Higher Education, while institutions from third countries not associated to the Programme commit to its principles through inter-institutional agreements [23], [27].

After institutional cooperation is established, higher education institutions publish information about available

mobility opportunities. Calls for applications should include the purpose of mobility, eligibility requirements, duration, host institution, application procedure, selection criteria, required documents, financial conditions and deadlines. Transparency at this stage is essential because all potential candidates must have equal access to information and understand how the selection process is organized [22].

The selection of participants should be based on clear and objective criteria. For student mobility, such criteria may include academic performance, relevance of the mobility period to the study programme, motivation, language competence, research interests, professional goals and the quality of the proposed learning or traineeship plan. For staff mobility, selection may take into account the relevance of the planned teaching or training activity, expected institutional impact, previous international experience, professional development needs and contribution to curriculum modernization or international cooperation [22].

Before the start of student mobility, the participant, the sending institution and the receiving institution must agree on the learning activities to be carried out abroad. This agreement is formalized through the Learning Agreement. The purpose of the Learning Agreement is to ensure transparent preparation of the mobility period and guarantee recognition of the activities successfully completed abroad [24]. For study mobility, it defines the educational components to be followed at the receiving institution and the components that will be recognized by the sending institution. For traineeships, it defines the tasks, expected learning outcomes, skills and competencies to be developed during the traineeship.

The Learning Agreement must be approved before the beginning of the mobility period by all three parties: the student, the sending institution and the receiving institution or organization [24]. This document is particularly important because it connects the mobility experience with the student's curriculum at the home university. If changes to the study programme become necessary during the mobility period, they should be agreed by all parties and documented in the relevant part of the Learning Agreement.

For staff mobility, the planned teaching or training activities are usually defined in a Mobility Agreement. It sets out the

programme of teaching or training, objectives, expected outcomes and added value of the mobility for the participant and both institutions [25]. Staff mobility can support the development of new teaching methods, modernization of educational components, exchange of good practices, improvement of international cooperation and strengthening of institutional capacity.

Another important document is the Grant Agreement, which regulates the financial and administrative conditions of mobility. It usually includes information about the duration of the mobility, amount of financial support, payment arrangements, participant obligations, insurance requirements, reporting procedures and other conditions connected with the mobility grant. The participant should clearly understand the financial rules before departure [22].

During the preparation stage, the sending and receiving institutions also provide administrative and practical support to participants. This may include assistance with visa procedures, travel planning, accommodation, insurance, language preparation, access to digital platforms, academic counselling and information about the host institution. For incoming participants, the receiving institution should provide orientation, access to learning facilities, academic support and information about local regulations and services [22].

The implementation stage begins when the participant arrives at the host institution or organization. During this period, the receiving institution is responsible for providing the agreed academic, training or research activities and supporting the participant's integration into the educational environment. The sending institution should maintain contact with the participant and monitor the progress of mobility. Regular communication between all parties helps identify possible academic, administrative or personal difficulties and solve them in time.

For student mobility, the participant attends courses, practical classes, laboratory work, traineeship activities, research consultations or other learning activities agreed in the Learning Agreement. The student should complete the required tasks, participate in assessment procedures and collect evidence of achieved learning outcomes. For staff mobility, the participant carries out the planned teaching, training or professional development activities and may also participate in meetings,

workshops, curriculum discussions or project-related activities [24], [25].

Monitoring is an important part of the implementation stage. It helps ensure that the mobility activities correspond to the agreed programme and that the participant receives appropriate support. Monitoring may include communication with academic coordinators, progress reports, consultations with supervisors, attendance records, feedback from the host institution and documentation of completed activities. In international projects, mobility data and results may also be recorded in the relevant project or Erasmus+ reporting tools [22].

The follow-up stage takes place after the mobility period is completed. Its main purpose is to recognize the results of mobility and evaluate its academic and institutional impact. For study mobility, the receiving institution issues a Transcript of Records, which confirms the educational components completed by the student, credits obtained and grades received. The sending institution then uses the Transcript of Records to complete the recognition procedure in accordance with the Learning Agreement [4], [16], [24].

Recognition of mobility results is one of the most important principles of academic mobility. The sending institution should recognize the credits and learning outcomes successfully achieved abroad in accordance with the Learning Agreement and the Transcript of Records. Recognition should normally be carried out without requiring the student to take additional examinations or repeat equivalent educational components at the home institution [4], [16], [24], [26]. The recognized mobility results should be included in the student's academic record and, where applicable, reflected in the Diploma Supplement.

For traineeships, the receiving organization or institution provides a confirmation or traineeship certificate describing the tasks performed, period of traineeship, acquired skills and evaluation of the participant's performance. The sending institution recognizes the traineeship according to the conditions defined in the Learning Agreement. Recognition may take the form of ECTS credits, inclusion in the Diploma Supplement, replacement of a compulsory traineeship component or recognition as a voluntary activity, depending on the structure of the study programme [24], [26].

After the mobility, participants are usually required to submit a report or provide feedback on their experience. Such feedback helps institutions evaluate the quality of mobility organization, identify strengths and weaknesses, improve support services and develop future cooperation with partner institutions. Mobility results may also be disseminated through presentations, reports, meetings, publications, project websites, social media or internal university events [22], [26].

Academic mobility has value not only for individual participants, but also for higher education institutions. For students, it supports academic progress, professional development, foreign language skills, intercultural communication, independence and employability. For teachers and staff, mobility provides opportunities for professional growth, exchange of teaching practices, development of international networks and modernization of educational programmes. For institutions, mobility strengthens international cooperation, improves visibility, supports curriculum development and contributes to quality enhancement [1], [22].

In the context of EMINReM, academic mobility is especially important because it allows students and staff from Ukraine, Kazakhstan and Uzbekistan to gain international experience in the fields of eco-mining, environmental protection, sustainable natural resources management, engineering education and innovative teaching methods. Mobility supports the transfer of European experience, strengthens cooperation between partner universities and contributes to the modernization of educational programmes in accordance with the goals of the project.

Therefore, the successful organization of academic mobility requires transparency, proper documentation, academic relevance, institutional support and full recognition of results. When these conditions are met, mobility becomes an effective tool for improving the quality of higher education, developing international cooperation and preparing graduates for professional activity in a globalized and rapidly changing environment [1], [4], [22].

3.2. Student Mobility within the EMINReM Project

Student mobility was one of the important components of the Erasmus+ EMINReM project, as it provided students from partner higher education institutions in Ukraine, Kazakhstan and Uzbekistan with the opportunity to gain international academic and practical experience at European universities. In accordance with Erasmus+ principles, mobility activities were aimed at strengthening learning outcomes, developing professional competencies, supporting international cooperation and ensuring the recognition of academic results achieved abroad [22], [24].

Within the EMINReM project, student mobility was closely connected with the overall aim of the project — modernization of education in the field of eco-mining and innovative natural resources management. The mobility activities allowed students to become familiar with European approaches to mining engineering, environmental protection, sustainable use of natural resources, mineral processing, occupational safety, digital technologies and research-based education [28].

The mobility periods were organized in cooperation between the home universities and the host European institutions. Before the mobility, students were selected according to transparent criteria and prepared for the academic and practical tasks to be completed abroad. The learning activities were agreed in advance in order to ensure that the mobility experience was relevant to the students' educational programmes, research interests and future professional development [22], [24].

Students from Zhytomyr Polytechnic State University and Donetsk National Technical University completed internships at the University of Jaén, Polytechnic School of Linares in Spain. Their mobility activities were focused on sustainable mining practices, innovative natural resources management, environmental protection, mine and groundwater assessment, eco-friendly mining technologies and research related to the environmental impact of mining activities [28].

During their internships at the University of Jaén, students had the opportunity to work with academic materials, scientific literature, laboratory facilities and research methods relevant to mining engineering and environmental protection. The Polytechnic School of Linares provided an academic

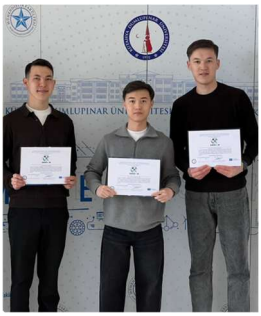
environment where students could deepen their understanding of engineering education, sustainable resource use and practical approaches to solving environmental problems connected with mining [28].

Students from Dnipro University of Technology and Tashkent State Technical University named after Islam Karimov completed internships at Technische Universität Bergakademie Freiberg in Germany. Their mobility activities were connected with mining, surface mining, metallurgy, mineral processing engineering, analysis of materials and technologies used in the mining sector. The mobility period also supported students' thesis work and helped them collect academic and research materials for further study [28].

At Technische Universität Bergakademie Freiberg, students became familiar with one of Europe's leading academic environments in the field of mining, geosciences, materials, energy and sustainable resource management. The internships

provided access to university libraries, scientific resources, consultations with academic staff and research-oriented activities. This helped students strengthen both theoretical understanding and practical awareness of modern mining and mineral processing technologies [28].

Students from Satbayev University, Abylkas Saginov Karaganda Technical University and Navoi State University of Mining and Technologies completed internships at Kütahya Dumlupınar University in Türkiye. Their mobility activities included attendance of classes, visits to laboratory facilities, study of mineral processing and separation methods, work with specialized software and practical tasks related to mining engineering, technical design, modelling, visualization and risk analysis [28].



The mobility at Kütahya Dumlupınar University helped students expand their practical knowledge of mining processes and mineral processing technologies. Particular attention was paid to applied learning, laboratory-based training and the use of digital tools such as Micromine and Surfer. These activities supported the development of technical, analytical and digital competencies needed for modern specialists in mining and natural resources management [28].

An important feature of the EMINReM student mobility was its connection with students' individual academic and research interests. Mobility was not limited to general familiarization with foreign universities. It was also used as a tool for supporting students' thesis preparation, research skills, professional orientation and understanding of European academic practices. Students could compare educational approaches, communicate

with academic staff, use research materials and participate in activities that complemented their studies at home universities [24], [28].

Student mobility also contributed to the development of intercultural communication skills. During the mobility periods, students worked in international academic environments, communicated with teachers and students from other countries, adapted to new educational settings and became more familiar with European university culture. Such experience is important for future specialists who will work in international projects, multinational companies, research teams or institutions connected with sustainable development and resource management.

The recognition of mobility results was an essential part of the process. In accordance with Erasmus+ and ECTS principles, the learning outcomes and activities completed abroad should be recognized by the home institution on the basis of the agreed mobility documents and academic results provided by the host institution [4], [16], [24]. This approach ensures that mobility becomes an integrated part of the educational process and does not create additional academic barriers for students after their return [26].

The EMINReM student mobility also strengthened cooperation between partner universities. Host institutions provided academic and practical support, while home institutions ensured preparation, communication and follow-up. This cooperation created opportunities for further curriculum modernization, development of new educational components, exchange of teaching materials and integration of EU-based approaches into technical and engineering education in partner countries [22], [28].

For students from Ukraine, Kazakhstan and Uzbekistan, participation in mobility activities helped develop professional competencies in eco-mining, environmental protection, mineral processing, risk assessment, digital modelling and sustainable natural resources management. The mobility experience also increased students' motivation, broadened their academic outlook and strengthened their readiness for future professional challenges in the mining and environmental sectors.

Thus, student mobility within the EMINReM project became an important mechanism for connecting academic learning

with practical experience, international cooperation and professional development. It supported the modernization of higher education in partner countries and contributed to the preparation of specialists capable of applying European experience and innovative approaches in the field of eco-mining and natural resources management.

3.3. Mobility Outcomes and Recognition

Recognition of mobility results is one of the key conditions for successful academic mobility. Mobility should not be understood only as a period of study or internship abroad. It is an integrated part of the educational process, which must be planned, documented, assessed and recognized by the home institution. This ensures that students' international experience contributes directly to their academic progress and professional development [4], [16], [24].

The main basis for recognition is the Learning Agreement, which defines the learning activities to be completed during the mobility period. Before departure, the student, the sending institution and the receiving institution agree on the study programme, traineeship tasks, expected learning outcomes and recognition conditions [24]. This document provides transparency and helps avoid misunderstandings after the mobility period is completed.

After the mobility, the host institution provides documents confirming the student's results. For study mobility, this is usually the Transcript of Records, which includes the educational components completed abroad, the number of credits obtained and the grades received. For traineeships, the host institution or organization may provide a traineeship certificate or confirmation describing the period of mobility, performed tasks, acquired skills and achieved learning outcomes [4], [16], [24].

The sending institution should recognize the successfully completed mobility activities in accordance with the Learning Agreement and the documents issued by the host institution. Recognition may include transfer of ECTS credits, replacement of educational components at the home institution, recognition of practical training, inclusion of mobility results in the student's

academic record or reflection of the mobility period in the Diploma Supplement [4], [16], [26].

A very important principle is that students should not be required to repeat equivalent courses or take additional examinations if the agreed learning outcomes were successfully achieved abroad. Proper recognition protects students from unnecessary academic workload and confirms that the mobility period has real academic value. It also strengthens trust between partner institutions and supports the transparency of international cooperation [4], [16], [26].

In the EMINReM project, recognition of mobility results was especially important because student internships were connected with professional training, research interests and the modernization of education in eco-mining and innovative natural resources management. Mobility activities helped students develop knowledge and skills in sustainable mining, environmental protection, mineral processing, digital modelling, risk analysis, resource management and research-based learning [28].

The impact of mobility can be seen at several levels. For students, mobility supported the development of professional competencies, foreign language skills, intercultural communication, independence, adaptability and confidence in an international academic environment. It also helped them collect materials for research and thesis work, communicate with academic staff from partner universities and better understand European approaches to technical and engineering education.

For higher education institutions, mobility contributed to curriculum modernization, exchange of academic experience and strengthening of cooperation between partner universities. Teachers and coordinators could use the results of student mobility to improve educational components, update practical tasks, introduce new teaching methods and better align study programmes with international standards and labour market needs.

Mobility also supported the broader objectives of the EMINReM project. It helped connect universities from Ukraine, Kazakhstan and Uzbekistan with European academic and research environments, promoted the transfer of good practices and strengthened the international dimension of eco-mining

education. Through mobility, students and institutions gained experience that can be used for further development of educational programmes, joint projects and long-term cooperation.

Thus, recognition and impact are closely connected. Without proper recognition, mobility remains only an individual experience. With transparent recognition procedures, it becomes a structured academic result that benefits students, universities and the project consortium as a whole. In this way, mobility within EMINReM contributed not only to students' personal and professional growth, but also to the modernization and internationalization of higher education in the field of eco-mining and natural resources management.

4. INNOVATIVE TEACHING METHODS IN ECO-MINING EDUCATION

4.1. Student-Centred and Teacher-Centred Learning

Modern higher education is gradually moving from traditional knowledge transmission towards more active, flexible and competence-based learning. In this context, two approaches are often compared: teacher-centred learning and student-centred learning. Both approaches can be used in higher education, but they differ in the role of the teacher, the role of students, the organization of learning activities and the methods of assessment.

Teacher-centred learning is a traditional educational approach in which the teacher plays the leading role in the learning process. The teacher explains new material, selects the content, controls the pace of learning, gives instructions and evaluates students' results. Students mainly listen, take notes, reproduce information and complete tasks according to the teacher's requirements. This approach is often associated with lectures, direct instruction, explanation, demonstration and summative assessment [21].

Teacher-centred learning has several advantages. It allows the teacher to present a large amount of information in a structured way, explain difficult theoretical concepts and maintain control over the learning process. This approach can be useful when students need to receive basic knowledge, understand terminology, become familiar with fundamental theories or learn standard procedures. In technical and engineering education, teacher-centred methods may be effective for explaining complex calculations, technological processes, safety rules or regulatory requirements.

At the same time, teacher-centred learning has certain limitations. If students remain passive for a long time, they may memorize information without fully understanding how to apply it in practice. This approach may provide fewer opportunities for discussion, independent thinking, teamwork, creativity and problem-solving. It can also limit students' responsibility for their own learning and reduce their motivation, especially when the

learning process is based mainly on lectures and reproduction of information.

Student-centred learning is an approach that places students and their learning needs at the centre of the educational process. It does not mean that the teacher becomes less important. Rather, the teacher's role changes from being the only source of knowledge to being a facilitator, mentor, organizer and supporter of learning. Students are expected to take an active role, participate in discussions, analyse information, solve problems, work independently and collaboratively, and reflect on their own progress [3].

Student-centred learning is closely connected with learning outcomes and competence-based education. The main question is not only what the teacher teaches, but what students are able to know, understand and do after completing a course, module or programme. This approach supports the development of practical skills, critical thinking, communication, autonomy, responsibility and the ability to apply knowledge in real professional situations [3], [4].

In student-centred learning, educational activities may include discussions, group work, case studies, problem-based tasks, project work, simulations, laboratory activities, presentations, peer learning and independent research. These methods help students become more involved in the learning process and encourage them to connect theoretical knowledge with practical tasks. This is especially important in eco-mining education, where students must understand not only technical processes, but also environmental, social, economic and safety-related consequences of professional decisions.

Assessment also differs in student-centred and teacher-centred approaches. In teacher-centred learning, assessment is often mainly summative and focuses on final results, such as exams or tests. In student-centred learning, formative assessment becomes more important. Students receive feedback during the learning process, analyse their mistakes, improve their work and gradually develop the required competencies. Peer assessment, self-assessment, project evaluation, practical tasks and portfolio-based assessment may also be used [3].

For eco-mining and innovative natural resources management education, student-centred learning is

particularly relevant. Future specialists must be able to analyse complex systems, assess environmental risks, work with digital tools, make decisions under uncertainty and cooperate with specialists from different fields. These competencies cannot be developed only through passive listening. Students need practical tasks, realistic scenarios and opportunities to test different solutions.

However, teacher-centred learning should not be completely rejected. In many cases, it remains useful and necessary. For example, when students are introduced to a new theoretical topic, safety instruction, legal framework or complex technical process, direct explanation by the teacher can provide a clear and reliable basis for further learning. Therefore, modern higher education often combines teacher-centred and student-centred approaches.

The most effective teaching model is usually a balanced one. The teacher provides structure, academic guidance and expert knowledge, while students actively participate in learning activities and apply knowledge in practice. For example, a teacher may first explain the principles of sustainable mining or environmental monitoring, and then students may work on a case study, analyse data, model a situation or propose practical solutions.

In the context of EMINReM, this balance is especially important. The project focuses on the modernization of education in eco-mining and innovative natural resources management, which requires both strong theoretical preparation and active practical learning. Teacher-centred methods can help students understand scientific and technical foundations, while student-centred methods can help them develop professional competencies, creativity, teamwork and decision-making skills.

The comparison of teacher-centred and student-centred learning can be summarized as follows:

Criterion	Teacher-Centred Learning	Student-Centred Learning
Main focus	Teacher, content and instruction	Student, learning process and learning outcomes
Role of the teacher	Main source of knowledge, instructor, controller	Facilitator, mentor, organizer and supporter
Role of students	Mostly passive receivers of information	Active participants in the learning process

Learning activities	Lectures, explanations, demonstrations, individual tasks	Discussions, projects, case studies, teamwork, problem-solving, simulations
Assessment	Mainly summative assessment focused on final results	Combination of formative and summative assessment, feedback, self-assessment and peer assessment
Advantages	Clear structure, efficient transfer of theoretical knowledge, teacher control	Active engagement, practical application, autonomy, critical thinking, teamwork
Limitations	Risk of passivity, limited interaction, weaker practical application	Requires more planning, active participation, time and classroom management
Use in eco-mining education	Useful for explaining theories, regulations, safety rules and technical concepts	Useful for analysing cases, solving environmental problems, modelling processes and developing professional competencies

Thus, student-centred and teacher-centred learning should not be viewed as mutually exclusive approaches. Both can contribute to effective higher education when used appropriately. The modernization of teaching in eco-mining education requires a thoughtful combination of structured academic guidance and active learning methods. Such an approach helps students acquire fundamental knowledge, develop practical skills and become better prepared for professional challenges in sustainable mining and natural resources management.

4.2. Gamification as an Innovative Teaching Tool

Gamification is increasingly used in modern higher education as an innovative teaching approach aimed at making the learning process more interactive, motivating and practice-oriented. In general, gamification means the use of game elements, game principles and game-based mechanics in non-game contexts. In education, this approach is applied to support learning objectives, encourage student engagement, develop practical skills and make complex topics easier to understand through active participation [29].

Gamification should not be understood as simply adding games to the classroom. Its purpose is not entertainment for its own sake. Instead, gamification uses selected elements of

games to improve the structure and quality of learning. Such elements may include points, levels, missions, challenges, badges, leaderboards, scenarios, role-playing activities, simulations, feedback systems, teamwork, competition and problem-solving tasks [29]. When these elements are connected with clear learning outcomes, they can make the educational process more meaningful and effective.

One of the main reasons for using gamification in higher education is its motivational potential. Traditional learning activities may sometimes seem abstract or distant from real professional practice. Gamified learning can help students become more involved by giving them clear goals, visible progress, immediate feedback and a sense of achievement. Students can see how their actions influence results, compare different strategies and gradually improve their performance [29], [30].

At the same time, recent studies emphasize that gamification is not automatically effective in every educational context. Its positive impact depends on instructional design, relevance to learning outcomes, students' needs, assessment methods and the way game elements are integrated into the course [30], [31]. If gamification is used only as a decorative element, without clear academic purpose, it may distract students from the content instead of supporting learning.

In technical and engineering education, gamification is especially useful because many professional situations require active decision-making, risk assessment, teamwork and problem-solving. These competencies cannot be developed only through theoretical lectures. Students need opportunities to test decisions, make mistakes, analyse consequences and try alternative solutions in a safe educational environment. Gamification can create such conditions through scenarios, simulations, case-based challenges and digital learning tasks.

Game elements may be used in different ways. Points can show progress and reward completed tasks. Badges can mark the achievement of specific competencies. Levels can divide complex learning content into manageable stages. Missions or quests can organize learning around practical problems. Leaderboards can create competition, although they should be used carefully to avoid excessive pressure. Storylines and role-playing activities can place students in professional situations

where they must act as engineers, environmental experts, safety inspectors, project managers or members of a mining team [29].

Feedback is one of the most important elements of gamified learning. In traditional education, students often receive feedback only after completing a test or final assignment. In gamified learning, feedback can be more immediate and continuous. Students can see whether their decisions are correct, what consequences they produce and how their performance can be improved. This supports formative assessment and helps students learn from mistakes during the learning process [29], [30].

Gamification also supports active learning. Instead of passively receiving information, students interact with tasks, make decisions, discuss solutions and reflect on results. This is closely connected with student-centred learning, where students take responsibility for their own learning progress and participate actively in the construction of knowledge [3]. In this way, gamification can become a practical tool for implementing student-centred approaches in technical education.

Another important aspect of gamification is teamwork. Many gamified activities can be organized as group challenges, where students must cooperate to solve a problem, distribute roles, analyse data and make collective decisions. This helps develop communication, leadership, responsibility and conflict-resolution skills. For eco-mining education, teamwork is particularly important because real professional tasks in mining and natural resources management usually require cooperation between engineers, environmental specialists, geologists, economists, safety experts and local communities.

Gamification can be applied both in face-to-face and digital learning environments. In the classroom, teachers can use role-playing activities, group competitions, scenario-based tasks, cards, maps, practical missions and case challenges. In online or blended learning, gamification can be integrated into learning management systems, digital platforms, mobile applications, virtual laboratories, simulations and interactive quizzes. Digital tools make it possible to track progress, provide automated feedback, visualize results and support independent learning [6], [29].

A special form of gamification is the use of serious games. Serious games are games designed not only for entertainment,

but also for educational, professional or training purposes. In higher education, serious games can help students understand complex systems, practise decision-making and explore professional situations that are difficult, expensive or dangerous to reproduce in real life [32]. For example, serious games may simulate emergency response, industrial processes, environmental risks, project management, resource extraction or occupational safety situations.

In mining and eco-mining education, serious games can be used to model underground or open-pit mining operations, mineral processing chains, environmental monitoring, waste management, water contamination risks, mine safety procedures and land reclamation. Students can analyse how different decisions influence productivity, environmental impact, safety and economic results. This allows them to see the connections between technical, environmental and managerial aspects of mining.

Digital simulations are another important tool closely connected with gamification. A simulation creates a model of a real process or system and allows students to interact with it. In eco-mining education, simulations can demonstrate geological structures, extraction processes, slope stability, groundwater movement, contamination spread, ventilation systems, mineral processing operations or waste storage management. When simulations include goals, challenges, feedback and decision-making, they become gamified learning environments [32].

Virtual reality and augmented reality technologies can further strengthen gamified learning. Virtual reality allows students to enter a simulated three-dimensional environment, while augmented reality adds digital elements to the real environment. In engineering and mining education, VR and AR can help students explore mine sites, equipment, geological formations, laboratory processes or hazardous situations without direct physical risk. These technologies are especially useful when real access to industrial sites is limited, expensive or unsafe [33].

The use of VR and AR in eco-mining education can support occupational safety training. Students may practise identifying hazards, following safety procedures, responding to emergency situations and making decisions under pressure. Such training is valuable because mistakes in real mining environments can

have serious consequences. In a virtual environment, students can learn from errors safely and repeat the task until they develop the necessary skills and confidence [33], [34].

Gamification can also help students understand sustainability challenges in mining. Eco-mining requires balancing resource extraction with environmental protection, social responsibility, economic efficiency and long-term land use. Gamified scenarios can present students with complex dilemmas: how to reduce environmental damage, choose cleaner technologies, manage industrial waste, protect water resources, improve occupational safety or plan land reclamation after mining activities. Students can compare different strategies and discuss their advantages and risks.

Another useful application is risk assessment. Students can be given a scenario involving a mining site, technological process or environmental problem. They may need to identify hazards, evaluate probability and consequences, propose preventive measures and justify their decisions. Points or levels can be connected not with speed, but with the quality of analysis, evidence-based reasoning and ability to consider safety, environmental and economic factors.

Gamification can also support the development of digital competencies. Students may work with specialized software, digital maps, modelling tools, data visualization platforms or virtual laboratories. By turning digital tasks into challenges or missions, teachers can make software training more engaging and closer to professional practice. For example, students may be asked to create a digital model of a mining area, analyse environmental data or visualize contamination pathways.

The effectiveness of gamification depends on careful instructional design. Game elements should not be added randomly. They must be connected with learning outcomes, course content, assessment criteria and students' level of preparation. A gamified activity should answer the following questions: What should students learn? What professional situation does the activity model? What decisions should students make? What feedback will they receive? How will their results be assessed? [30], [31]

It is also important to avoid reducing gamification to simple competition. Although competition can increase motivation for some students, it may discourage others. Therefore, gamified

learning should combine competition with cooperation, reflection and personal progress. Not all students need to be compared with each other. In many cases, it is more useful to compare students' current performance with their previous results and help them see their own progress.

Assessment in gamified learning should be transparent and fair. Students should understand how points, badges, levels or other indicators are connected with academic results. Game rewards should not replace real assessment of knowledge and competencies. They should support the learning process and provide additional motivation. The final evaluation should still be based on clear criteria, learning outcomes and evidence of students' achievements.

Teachers play a central role in the successful use of gamification. Even when digital tools are used, the teacher remains responsible for planning the activity, explaining the rules, supporting students, guiding reflection and connecting the gamified experience with theoretical knowledge. After a gamified task, discussion and reflection are especially important. Students should analyse what happened, why certain decisions were successful or unsuccessful, and how the experience relates to real professional practice.

Gamification can be introduced gradually. A course does not need to be fully transformed into a game. Teachers may start with small elements such as progress indicators, scenario-based tasks, digital quizzes, group missions, role distribution or practical challenges. Later, more complex elements can be added, including simulations, serious games, virtual laboratories or VR/AR activities. This gradual approach makes gamification easier to implement and adapt to different educational contexts.

There are also certain limitations and challenges. Gamification may require additional time, technical resources, teacher training and access to digital tools. Some students may focus too much on points or competition rather than learning outcomes. Poorly designed gamification can become superficial and distract from academic content. Therefore, teachers should use gamification thoughtfully and evaluate whether it really improves learning [30], [31].

In the context of EMINReM, gamification is especially relevant because the project focuses on the modernization of education in eco-mining and innovative natural resources management.

These fields require interdisciplinary knowledge, practical decision-making, environmental awareness, digital skills and the ability to work with complex systems. Gamified learning can help students connect theory with practice and better understand the consequences of professional decisions.

Gamification can be used in EMINReM courses to teach topics such as sustainable mining, mineral processing, environmental monitoring, water protection, waste management, occupational safety, risk assessment, circular economy and resource efficiency. For example, students may work in teams to design a sustainable mining project, respond to an environmental incident, optimize a mineral processing chain, assess risks at a mining site or propose a reclamation strategy for a disturbed area.

Such activities can make learning more realistic and professionally oriented. Students do not only memorize definitions or formulas. They apply knowledge, analyse information, make decisions, justify solutions and receive feedback. This supports the development of competencies that are important for future specialists in mining engineering, environmental protection and natural resources management.

Gamification also supports international and intercultural learning. In project-based or mobility-related activities, students from different countries can work together on common challenges, compare national contexts, exchange ideas and develop joint solutions. This is particularly valuable for EMINReM, as the project brings together universities from Ukraine, Kazakhstan, Uzbekistan and the European Union. Gamified tasks can become a bridge between different educational systems and professional experiences.

Thus, gamification is not a replacement for traditional teaching methods, but an additional tool that can make higher education more active, engaging and practice-oriented. When properly designed, it can support motivation, feedback, teamwork, digital competence, problem-solving and professional decision-making. In eco-mining education, gamification can help students better understand complex technical and environmental challenges and prepare for real professional situations in sustainable mining and natural resources management.

4.3. Practice-Oriented Teaching Methods

Practice-oriented teaching methods play an important role in modern technical and engineering education. Their main purpose is to help students connect theoretical knowledge with real professional tasks, develop practical skills and prepare for complex situations that they may face in their future careers. In eco-mining and natural resources management education, practice-oriented learning is especially important because students need to understand not only scientific concepts, but also technological processes, environmental risks, safety requirements, resource efficiency and decision-making in real industrial contexts.

Traditional lectures remain useful for explaining basic theories, terminology, regulations and technical principles. However, lectures alone are not sufficient for developing professional competencies. Future specialists in mining engineering, environmental protection and natural resources management must be able to analyse problems, work with data, use digital tools, cooperate in teams, justify decisions and evaluate the consequences of their actions. Practice-oriented methods create learning situations where students can apply knowledge instead of only reproducing it.

One of the most widely used practice-oriented approaches is problem-based learning. In problem-based learning, students work with a specific problem that does not have one simple answer. They need to identify what they already know, determine what additional information is needed, analyse possible solutions and justify their final decision. The teacher does not simply provide ready-made answers, but guides the learning process, asks questions, supports discussion and helps students reflect on their work.

In eco-mining education, problem-based learning can be used for analysing environmental risks, choosing appropriate mining technologies, assessing occupational safety situations, planning waste management measures or solving water contamination problems. For example, students may be asked to analyse a case where mining activity affects groundwater quality. They would need to study the available data, identify

possible sources of contamination, assess risks and propose measures for monitoring, prevention or remediation.

Project-based learning is another important method in engineering education. It allows students to work on a larger task over a longer period of time and produce a concrete result, such as a technical report, digital model, environmental assessment, project proposal, presentation, prototype or practical solution. Recent studies in engineering education emphasize that project-based learning can support the development of real-world skills, teamwork, problem-solving, communication and professional responsibility [35].

In the context of eco-mining, project-based learning can be used to design a sustainable mining plan, develop a reclamation strategy, prepare an environmental monitoring programme, model a mineral processing chain or propose improvements for resource efficiency. Such projects help students understand the complexity of professional tasks, where technical, environmental, economic and social factors must be considered together.

Challenge-based learning is closely related to project-based learning, but it usually begins with a broader real-world challenge. Students are encouraged to investigate the problem, formulate specific questions, develop solutions and present their results. In engineering education, challenge-based learning can promote student engagement with complex societal and technological problems, especially when tasks are connected with real professional or community needs [36].

For EMINReM-related education, challenge-based learning may be particularly useful because eco-mining itself is connected with global and local challenges: sustainable resource extraction, reduction of environmental impact, circular economy, water protection, waste management, occupational safety and responsible innovation. Students may work on challenges such as “How can mining waste be reduced?”, “How can water resources be protected near mining sites?” or “How can digital technologies improve environmental monitoring?”

Case studies are also an effective practice-oriented method. A case study presents a real or realistic situation that students must analyse. It may include technical data, maps, diagrams, environmental reports, economic information, legal requirements or descriptions of stakeholder positions. Students

examine the case, identify the main problem, compare possible solutions and explain their reasoning. Case studies help develop analytical thinking and decision-making skills because they are usually based on complex situations with several possible interpretations.

In eco-mining education, case studies may focus on accidents at mining sites, environmental pollution, land reclamation, mine closure, conflict between industrial development and community interests, implementation of cleaner technologies or assessment of occupational risks. Such cases help students understand that professional decisions in mining and natural resources management are rarely purely technical. They often involve environmental, social, legal and ethical dimensions.

Digital simulations can strengthen practice-oriented learning by allowing students to work with models of real processes and systems. Simulations can represent geological structures, mine ventilation, slope stability, groundwater movement, contamination spread, mineral processing, waste storage or equipment operation. Students can test different scenarios, observe consequences and understand relationships between variables. This is especially valuable when real experiments are dangerous, expensive or difficult to organize.

Virtual laboratories are another important tool for practice-oriented education. They provide students with access to laboratory activities through digital environments. In engineering education, virtual laboratories can support experimentation, visualization of processes, independent learning and preparation for real laboratory work [37]. They are particularly useful when physical equipment is limited, when students need additional practice or when certain processes cannot be easily demonstrated in a traditional classroom.

In eco-mining education, virtual laboratories may be used to study mineral processing, material properties, environmental monitoring, water quality analysis, geotechnical processes or risk assessment. Students can repeat procedures, compare results and learn from mistakes without damaging equipment or creating safety risks. However, virtual laboratories should not completely replace real laboratory and field work. They are most effective when combined with physical experiments, practical training and teacher guidance.

Field work remains one of the most valuable practice-oriented methods in mining and environmental education. Visits to mining sites, laboratories, processing plants, reclamation areas, environmental monitoring stations or industrial enterprises help students see how theoretical knowledge is applied in practice. Field work allows students to observe real equipment, technological processes, safety procedures and environmental protection measures. It also helps them understand the scale and complexity of mining-related activities.

Laboratory work is equally important. Through laboratory activities, students learn to use equipment, follow procedures, collect data, make measurements, analyse samples and interpret results. Laboratory work develops accuracy, responsibility, technical skills and scientific thinking. In eco-mining education, laboratory tasks may include analysis of rocks and minerals, water quality testing, soil analysis, mineral separation, material testing or assessment of pollution indicators.

Cooperation with industry can further strengthen practice-oriented education. Guest lectures, industrial consultations, internships, joint projects, site visits and real company cases help students understand current professional requirements and labour market expectations. Industry cooperation also allows universities to update educational content, introduce modern technologies and ensure that graduates acquire relevant competencies.

Practice-oriented methods also support interdisciplinary learning. Eco-mining and natural resources management require knowledge from engineering, geology, ecology, chemistry, economics, digital technologies, occupational safety and project management. Practice-oriented tasks can bring these fields together. For example, a student project on mine reclamation may include geological analysis, environmental assessment, economic justification, risk management and communication with stakeholders.

Another advantage of practice-oriented learning is the development of soft skills. Students learn to communicate, work in teams, distribute responsibilities, manage time, present results and defend their decisions. These skills are essential for professional activity, especially in international and

interdisciplinary environments. In many cases, the process of solving a practical task is as important as the final answer because it shows how students think, cooperate and respond to difficulties.

Assessment of practice-oriented learning should be based on clear criteria. Teachers may evaluate not only the final result, but also the process of work, quality of analysis, use of evidence, creativity, teamwork, presentation skills and reflection. Reports, portfolios, presentations, practical demonstrations, peer assessment and self-assessment can be used together with traditional tests or exams. This makes assessment more connected with real competencies.

At the same time, practice-oriented teaching methods require careful planning. Tasks must be realistic, but also appropriate for students' level of preparation. Teachers should provide clear instructions, necessary resources, assessment criteria and feedback. If tasks are too simple, students may not develop higher-level thinking. If they are too complex, students may become confused or demotivated. Therefore, practice-oriented learning should be gradually introduced and properly supported.

In the context of EMINReM, practice-oriented teaching methods are essential for the modernization of eco-mining education. They help students move from theoretical understanding to professional action. Through problem-based learning, project work, case studies, simulations, virtual laboratories, field work and industry cooperation, students can develop competencies needed for sustainable mining, environmental protection, resource efficiency, circular economy, occupational safety and digital transformation.

Thus, practice-oriented teaching methods make higher education more relevant to real professional challenges. They help students apply knowledge, analyse complex situations, work with digital and laboratory tools, cooperate with others and make responsible decisions. For eco-mining and innovative natural resources management education, these methods are not only useful additions to traditional teaching, but necessary instruments for preparing specialists capable of working in a rapidly changing technological and environmental context.

5. DISTANCE, BLENDED AND HYBRID LEARNING

5.1. Distance and Online Learning

Distance and online learning are important components of modern higher education. They allow students to access educational materials, communicate with teachers, complete assignments and participate in learning activities without being physically present in the classroom. These formats became especially visible during the rapid digital transformation of education and are now widely used as part of flexible and inclusive learning strategies [6], [38].

Distance learning usually means that the teacher and students are separated by location, while the educational process is organized through digital tools, online platforms and electronic communication. Online learning is often understood as a form of distance learning in which the Internet is the main environment for delivering content, interaction, assessment and feedback. In practice, these terms are closely connected and often overlap.

The main elements of distance and online learning include learning management systems, video conferencing tools, digital libraries, online courses, electronic assignments, discussion forums, cloud documents, interactive quizzes and digital assessment tools. These instruments help organize learning materials, monitor progress and support communication between teachers and students.

In technical and engineering education, distance and online learning can be used for theoretical lectures, consultations, independent work, digital modelling tasks, data analysis, virtual laboratory preparation, project discussions and presentation of results. However, practical disciplines often require a careful combination of online activities with laboratory work, field training or work with specialized equipment.

Independent learning plays a particularly important role in online education. Students need to manage their time, follow instructions, complete tasks regularly and communicate with teachers when difficulties appear. Therefore, online courses should have a clear structure, understandable deadlines, accessible materials and regular feedback.

Online assessment may include tests, written assignments, project reports, presentations, digital portfolios, peer assessment and oral examinations through video conferencing tools. Assessment should be transparent, connected with learning outcomes and supported by clear criteria. In technical education, it is also important to assess not only theoretical knowledge, but also problem-solving skills, data interpretation, digital competencies and the ability to apply knowledge to practical tasks.

At the same time, distance and online learning have certain limitations. They may reduce direct interaction, make it more difficult to organize laboratory or field work, require stable Internet access and demand higher levels of digital competence from both teachers and students. For this reason, online learning should be carefully designed and supported by appropriate institutional resources, teacher training and quality assurance procedures [6], [38].

5.2. Blended and Hybrid Learning

Blended learning combines face-to-face education with online learning activities. In this model, part of the educational process takes place in the classroom, laboratory or field environment, while another part is organized through digital platforms and online communication. Blended learning allows teachers to combine the strengths of traditional and digital education [39].

In blended learning, classroom time can be used for discussion, laboratory work, practical tasks, teamwork, consultations and problem-solving, while online components can include video lectures, readings, quizzes, digital simulations, independent assignments and preparation for practical classes. This model can make learning more flexible and help students use classroom time more actively.

Hybrid learning is closely related to blended learning, but it usually emphasizes the simultaneous or flexible participation of students in different formats. For example, some students may attend a class physically, while others join online. Hybrid learning can also combine synchronous activities, where teachers and

students interact in real time, with asynchronous activities, where students work with materials and tasks at a convenient time.

For eco-mining education, blended and hybrid formats are particularly useful because they allow theoretical, digital and practical components to be combined. Students can study theoretical materials online, analyse data or complete preparatory tasks before class, and then use face-to-face sessions for laboratory work, field activities, case studies, simulations or project discussions.

Blended and hybrid learning can also support international cooperation. Students and teachers from different universities can participate in joint online lectures, virtual seminars, project meetings, international teamwork and shared digital learning activities. This is especially relevant for Erasmus+ projects, where partner institutions may be located in different countries and need flexible formats for cooperation.

However, blended and hybrid learning require careful planning. Teachers should clearly define which activities are better organized online and which should take place face-to-face. Digital and classroom components should complement each other, not duplicate each other. Students should understand the logic of the course, the sequence of activities, assessment criteria and communication rules.

In technical education, blended and hybrid learning should also take into account access to equipment, software, laboratories and field sites. Digital activities can prepare students for practical work, but they cannot always replace direct contact with real equipment and industrial environments. Therefore, the most effective model is usually a balanced combination of online, classroom and practical activities.

5.3. Advantages, Challenges and Development Perspectives

Distance, blended and hybrid learning provide several important advantages for higher education. They increase flexibility, allow students to access materials from different locations, support independent learning and create opportunities for international cooperation. Digital platforms

can also help teachers provide additional resources, monitor student progress, organize feedback and use interactive learning tools [6], [40].

For students, digital learning formats can be useful because they allow repeated access to lectures, presentations, instructions, recordings, datasets and other materials. This is especially helpful in technical disciplines, where complex concepts often need to be reviewed several times. Online resources can also support students with different learning speeds and different levels of preparation.

For teachers, digital learning provides opportunities to use interactive quizzes, simulations, virtual laboratories, digital maps, modelling tools, collaborative documents and online feedback. These tools can make the educational process more dynamic and support active learning. In eco-mining education, digital formats can help visualize complex processes such as groundwater movement, mineral processing chains, environmental monitoring data or risk scenarios.

At the same time, digital learning creates challenges. Not all students and teachers have equal access to devices, software, stable Internet connection or quiet learning spaces. Digital inequality can reduce the effectiveness of online education and should be considered by institutions. Accessibility, inclusion and technical support are therefore important conditions for successful digital learning [38].

Student engagement is another challenge. In online environments, students may feel isolated, lose motivation or participate less actively. To prevent this, teachers should use regular communication, clear deadlines, interactive tasks, feedback, group work and opportunities for discussion. The design of the course should encourage participation rather than simply provide materials for independent reading.

Quality assurance is also essential. Digital learning should meet the same academic standards as face-to-face education. Courses should have clear learning outcomes, structured content, appropriate assessment methods, reliable communication channels and support for students. Institutions should also provide teacher training, technical infrastructure and guidelines for online, blended and hybrid teaching [6], [39].

For technical and engineering education, one of the main challenges is the organization of practical training. Some

competencies require direct work with equipment, materials, laboratories, field sites or industrial processes. Digital tools can support preparation, visualization and simulation, but they should be combined with real practical experience whenever possible.

The development perspectives of distance, blended and hybrid learning are closely connected with digital transformation, artificial intelligence, virtual laboratories, immersive technologies, data-driven education and international cooperation. These formats are likely to remain an important part of higher education, not as a temporary replacement for classroom teaching, but as flexible models that can enrich the learning process.

In the context of EMINReM, distance, blended and hybrid learning can support the modernization of eco-mining education by making educational materials more accessible, strengthening cooperation between partner universities and integrating digital tools into technical training. These formats can help students develop digital competencies, participate in international learning activities and prepare for professional work in a technologically advanced and environmentally responsible mining sector.

Thus, distance, blended and hybrid learning should be understood as complementary formats that expand the possibilities of higher education. When properly designed and supported, they can improve flexibility, accessibility, student engagement and international cooperation. In eco-mining and natural resources management education, they are especially valuable when combined with practice-oriented teaching methods, laboratory work, simulations and real professional tasks.

6. DEVELOPMENT PERSPECTIVES OF HIGHER EDUCATION IN ECO-MINING AND NATURAL RESOURCES MANAGEMENT

6.1. European Approaches to Quality Assurance and Sustainable Education

The development of higher education in Europe is closely connected with quality assurance, sustainability, digital transformation and the preparation of graduates for the green and digital transitions. Universities are increasingly expected not only to provide academic knowledge, but also to support innovation, lifelong learning, social responsibility, environmental awareness and cooperation with industry and society [1], [5], [41]. These priorities are especially important for technical and engineering education, where graduates must be prepared to solve complex professional problems in rapidly changing technological, economic and environmental conditions.

Quality assurance remains one of the key principles of the European Higher Education Area. It helps higher education institutions improve study programmes, teaching methods, assessment, student support, research-based education and institutional management. The Standards and Guidelines for Quality Assurance in the European Higher Education Area emphasize that quality assurance should be connected with learning outcomes, student-centred learning, transparency, stakeholder involvement and continuous improvement [5]. This means that quality assurance is not only a formal procedure, but also a tool for developing a quality culture within universities.

In modern European higher education, quality assurance is closely linked to curriculum design. Educational programmes should be based on clearly defined learning outcomes, appropriate teaching and assessment methods, student workload, and the needs of society and the labour market. For engineering and eco-mining education, this means that curricula should include not only fundamental technical knowledge, but also practical skills, environmental responsibility, digital competencies, safety culture, communication and interdisciplinary problem-solving.

Student-centred learning is another important element of European approaches to quality education. It encourages students to take an active role in the learning process and

supports the development of autonomy, critical thinking, creativity and responsibility [3]. In the context of eco-mining education, student-centred learning can be implemented through project work, case studies, simulations, laboratory tasks, field work, digital modelling and problem-based learning. These methods help students apply knowledge to realistic professional situations and understand the consequences of technical decisions.

Sustainable education has become a major priority for European universities. It means that environmental, social and economic dimensions of sustainable development should be integrated into curricula, research, institutional strategies and cooperation with external partners. For engineering education, this is especially relevant because future specialists must be able to design and implement technical solutions that reduce environmental impact, support resource efficiency and contribute to responsible industrial development [8], [41].

Sustainability in higher education is not limited to separate environmental courses. It should be reflected across educational programmes, teaching methods, research activities and institutional practices. In technical universities, sustainability may be integrated through topics such as circular economy, cleaner production, responsible use of natural resources, waste reduction, water protection, energy efficiency, occupational safety, environmental monitoring and climate awareness. This approach helps students understand that engineering decisions are connected with long-term environmental and social consequences.

Digital transformation is another major direction of higher education development. European approaches emphasize the use of digital technologies, online and blended learning, virtual laboratories, data-based tools, artificial intelligence, digital platforms and open educational resources [6], [40], [41]. At the same time, digitalization should not be limited to the introduction of technologies. It should improve the quality of learning, support accessibility, develop digital competencies and strengthen cooperation between universities.

In engineering and eco-mining education, digital transformation has particular importance. Students need to work with modelling software, geographic information systems, environmental monitoring data, digital maps, remote sensing

tools, virtual laboratories, simulations and data visualization platforms. These tools can help students understand complex processes, analyse risks, test scenarios and make evidence-based decisions. Digital technologies also support international cooperation, joint online courses, virtual mobility and shared educational resources between partner universities.

Green skills are also becoming increasingly important in European higher education. They include knowledge, abilities and attitudes needed to support sustainable development, environmental protection, circular economy, climate awareness and responsible use of natural resources [8], [42]. For eco-mining education, green skills should be combined with engineering competencies, digital skills, safety culture, risk assessment and understanding of the environmental consequences of mining activities.

The development of green skills requires changes in both content and teaching methods. Students should not only learn definitions related to sustainability, but also practise applying them in professional contexts. For example, they may analyse environmental risks at mining sites, compare technologies according to their environmental impact, design waste management solutions, assess water protection measures or develop reclamation strategies. Such tasks help students understand sustainability as a practical professional responsibility.

European approaches also emphasize lifelong learning. Rapid technological changes, digitalization, green transition and labour market transformation require specialists to update their knowledge and skills throughout their careers [7], [41]. For mining and natural resources management, this is particularly relevant because technologies, safety standards, environmental requirements and resource management practices continue to evolve. Higher education institutions should therefore support flexible learning pathways, professional development, micro-credentials and opportunities for upskilling and reskilling.

Cooperation with external stakeholders is another important feature of European higher education development. Universities are encouraged to cooperate with industry, public authorities, research institutions, professional associations and local communities. Such cooperation helps make educational programmes more relevant, supports internships and applied

research, and allows students to work with real professional challenges. In eco-mining education, stakeholder cooperation is especially important because mining activities affect industry, the environment, workers, communities and public policy.

European policy also pays growing attention to critical raw materials, circular economy and resource security. The European Critical Raw Materials Act highlights the importance of secure and sustainable supply chains, extraction, processing and recycling of strategic raw materials [44]. This creates new expectations for mining and natural resources education: future specialists must understand not only extraction technologies, but also recycling, environmental protection, social responsibility and resource efficiency.

The circular economy approach is particularly relevant for eco-mining education. It shifts attention from a linear model of extraction, use and disposal to a more responsible model based on reduction of waste, reuse of materials, recycling, resource efficiency and recovery of valuable components [43]. For students, this means understanding the full life cycle of mineral resources, including extraction, processing, use, waste management, secondary raw materials and environmental restoration.

International cooperation is also central to European approaches to higher education. Academic mobility, joint projects, curriculum development, research cooperation and shared educational resources help universities exchange experience and improve the quality of education. For partner countries, cooperation with European universities supports modernization of curricula, implementation of ECTS-based approaches, development of learning outcomes, quality assurance and innovative teaching methods [1], [4], [22].

For eco-mining and natural resources management, European approaches provide a useful framework for developing modern educational programmes. Such programmes should combine quality assurance, student-centred learning, sustainability, digital transformation, green skills, lifelong learning and cooperation with stakeholders. They should prepare graduates who are able to work responsibly in a sector that is technologically complex, environmentally sensitive and strategically important.

Therefore, European approaches to quality assurance and sustainable education are not separate or isolated priorities. They form an integrated model of higher education development, where quality, relevance, sustainability, innovation and international cooperation support each other. In the context of EMINReM, this model can guide the modernization of eco-mining education and help partner universities prepare specialists capable of contributing to sustainable mining, environmental protection and responsible natural resources management.

6.2. Higher education development in Georgia: tendencies, EU standards adjustment, problem matters and solution approaches

Higher education systems in Ukraine, Kazakhstan and Uzbekistan are developing in different national, economic and institutional contexts, but they face similar challenges connected with modernization, internationalization, digitalization and the need to strengthen cooperation with industry. For technical universities, these challenges are particularly important because engineering and mining education must respond to changes in technology, labour market needs, environmental standards and global sustainability priorities.

In Ukraine, the development of higher education is strongly connected with European integration, implementation of Bologna Process principles, quality assurance, academic mobility and international cooperation [9]. Ukrainian universities continue to adapt educational programmes to the requirements of the European Higher Education Area, strengthen the use of ECTS, develop learning outcomes and improve mechanisms for the recognition of academic achievements. These processes create a basis for deeper cooperation with European universities and for the modernization of technical education.

Technical universities in Ukraine play an important role in training specialists for engineering, mining, environmental protection, digital technologies, industrial recovery and sustainable development. In the field of eco-mining and natural

resources management, Ukrainian higher education institutions need to combine strong engineering traditions with modern approaches to environmental protection, resource efficiency, circular economy, occupational safety and digital transformation. This is especially relevant in the context of post-war recovery, reconstruction of infrastructure and the need for environmentally responsible industrial development.

For Ukraine, further development of eco-mining education is linked with curriculum modernization, stronger practical training, cooperation with European partners and integration of sustainable development principles into engineering programmes. Educational components should increasingly include topics such as environmental monitoring, waste management, water protection, land reclamation, risk assessment, digital modelling and responsible use of mineral resources. At the same time, universities need access to modern equipment, specialized software, international research materials and updated teaching methods.

Kazakhstan has been a member of the European Higher Education Area since 2010 and continues to develop its higher education system in line with Bologna Process principles [10]. The country has strong traditions in mining, metallurgy, engineering and industrial education, which are closely connected with its natural resource potential and industrial structure. Higher education institutions in Kazakhstan train specialists for sectors that are strategically important for the national economy, including mining, metallurgy, energy, geology and technological industries.

For Kazakhstan, development perspectives in eco-mining education are connected with the modernization of mining and engineering programmes, strengthening of research-based education, expansion of academic mobility and improvement of practical training. Students should be prepared not only to work with traditional mining technologies, but also to understand environmental risks, resource efficiency, industrial safety, digital tools and sustainable management of mineral resources. This requires an interdisciplinary approach that combines engineering, ecology, economics, digital technologies and management.

Kazakhstani universities can also benefit from stronger cooperation with industry. Mining companies, research

institutions and public authorities can help universities update educational content, organize internships, provide real case studies and support applied research. Such cooperation is important because students need to understand current industrial processes, modern equipment, safety standards and environmental requirements. It also helps universities make educational programmes more relevant to labour market needs.

Uzbekistan is actively reforming its higher education system, including the introduction of credit-module approaches, modernization of educational programmes, expansion of international cooperation and improvement of institutional capacity [11], [13]. These reforms create opportunities for increasing transparency, improving student workload organization and strengthening the compatibility of Uzbek higher education with international educational practices. For technical universities, these changes are especially important because they support the transition from mainly content-based education to more competence-based and practice-oriented learning.

Technical, mining and engineering education are highly important for Uzbekistan because of the country's industrial development and natural resource potential. Future specialists need to be prepared for work in mining, metallurgy, energy, environmental protection and technological sectors. Therefore, higher education programmes should include not only theoretical technical disciplines, but also practical training, laboratory work, digital tools, environmental assessment, resource management and occupational safety.

For Uzbekistan, one of the important development directions is the strengthening of links between universities, industry and international partners. Cooperation with European universities can support curriculum modernization, teacher training, academic mobility, development of new educational materials and introduction of innovative teaching methods. At the same time, cooperation with national industries can help ensure that educational programmes reflect real professional needs and technological priorities.

For all three partner countries, internationalization remains a key development direction. Participation in Erasmus+ projects, academic mobility, joint educational initiatives and cooperation with European universities help strengthen institutional

capacity and introduce new teaching and learning approaches. International cooperation also supports the recognition of learning outcomes, development of English-language educational components, exchange of academic experience and modernization of curricula.

Digitalization is another common priority for Ukraine, Kazakhstan and Uzbekistan. Universities need modern learning management systems, digital resources, virtual laboratories, simulation tools, online communication platforms and teacher training in digital pedagogy. In technical education, digitalization should support not only distance learning, but also modelling, data analysis, environmental monitoring, risk assessment, visualization of technological processes and work with professional software.

The development of digital competencies is particularly important for eco-mining education. Modern mining and natural resources management increasingly rely on digital maps, modelling systems, monitoring technologies, remote sensing, databases, artificial intelligence tools, automation and specialized engineering software. Students should be able to use these tools not as separate technical instruments, but as part of professional decision-making and environmental risk assessment.

Cooperation with industry is essential for the development of eco-mining and natural resources management education in all three countries. Universities should work more closely with mining companies, environmental organizations, research institutions, local communities and public authorities. Such cooperation can help update curricula, organize internships, develop real case studies, support applied research and ensure that graduates acquire competencies relevant to modern professional practice.

Another common development direction is the strengthening of practice-oriented education. Engineering and mining students need more opportunities to work with real or realistic professional tasks: laboratory experiments, field data, industrial case studies, project-based learning, digital simulations, virtual laboratories and internships. Practice-oriented teaching helps students better understand how theoretical knowledge is applied in professional contexts and

prepares them for work in complex industrial and environmental conditions.

Quality assurance is also a shared priority. Ukraine, Kazakhstan and Uzbekistan need to continue developing internal quality assurance systems, external evaluation procedures, transparent assessment methods and stakeholder involvement. For eco-mining education, quality assurance should focus not only on formal programme requirements, but also on the relevance of learning outcomes, practical training, digital competencies, environmental responsibility and employability of graduates.

The main challenges for partner countries include the need to update educational content, improve practical training, strengthen quality assurance, provide access to modern equipment and software, develop digital competencies and support teachers in implementing innovative methods. Another important challenge is the need to balance national educational traditions with international standards and European approaches. This requires careful adaptation rather than mechanical copying of foreign models.

At the same time, these challenges create opportunities for transformation. Through international projects such as EMINReM, partner universities can modernize educational programmes, test new teaching approaches, develop joint materials and build long-term cooperation in eco-mining education. The project provides a platform for sharing European experience, strengthening academic mobility, improving teaching methods and supporting the development of specialists for sustainable mining and innovative natural resources management.

Thus, the development perspectives of higher education in Ukraine, Kazakhstan and Uzbekistan are closely connected with modernization, international cooperation, digital transformation, industry partnership and sustainability. In the field of eco-mining, these directions are especially important because future specialists must be able to combine technical knowledge with environmental awareness, digital skills, safety culture and responsible decision-making. The EMINReM project supports this transformation by helping partner universities align educational programmes with modern European

approaches and the needs of sustainable industrial development.

6.3. Future Directions for Eco-Mining and Innovative Natural Resources Management Education

The future development of education in eco-mining and innovative natural resources management should respond to the growing need for specialists who can combine engineering knowledge with environmental responsibility, digital competence and sustainable decision-making. Eco-mining is not limited to the extraction of mineral resources. It requires an integrated understanding of the full resource cycle, including exploration, extraction, processing, waste management, recycling, environmental monitoring, occupational safety and land restoration.

One of the key future directions is sustainable mining. Educational programmes should help students understand how mining activities can be planned and managed in a way that reduces environmental impact, improves safety and supports responsible use of natural resources. This includes cleaner technologies, reduction of emissions, protection of ecosystems, efficient use of water and energy, responsible mine closure and long-term monitoring of post-mining territories.

Circular economy is another important direction. Future specialists should understand how materials can be reused, recycled and returned to production cycles. In mining education, this means paying attention to mineral waste, secondary raw materials, tailings reprocessing, recycling of critical raw materials and reduction of resource losses [43], [44]. Students should learn to view waste not only as an environmental problem, but also as a potential source of valuable materials.

Water protection and waste management should also be central components of updated educational programmes. Mining activities may affect surface water, groundwater, soil and ecosystems, so students need to understand environmental monitoring, contamination risks, treatment technologies, hydrogeological processes and prevention measures. Courses should include practical tasks connected with water quality

assessment, modelling of contamination pathways, waste reduction, secondary use of materials and remediation strategies.

Occupational safety and risk management should be strengthened in all eco-mining programmes. Future specialists must be able to identify hazards, assess risks, follow safety procedures and make responsible decisions in complex industrial environments. Digital simulations, VR/AR tools, serious games and case studies can be used to make safety training more realistic and practice-oriented [33], [34]. Such methods allow students to practise decision-making in hazardous situations without direct physical risk.

Environmental monitoring and digital technologies will also shape the future of eco-mining education. Students need to work with data, maps, modelling tools, sensors, remote sensing, geographic information systems, specialized mining software and visualization platforms. Digital competencies should be integrated into professional courses rather than treated as separate technical skills. This will help students use digital tools for real professional tasks, including risk assessment, resource modelling, environmental analysis and decision-making.

Interdisciplinary learning should become one of the foundations of eco-mining and innovative natural resources management education. This field requires knowledge from mining engineering, geology, ecology, chemistry, hydrology, economics, occupational safety, digital technologies, project management and public policy. Educational programmes should therefore help students understand connections between different fields and develop the ability to work in interdisciplinary teams.

Cooperation with industry and international partners should also be strengthened. Mining companies, environmental organizations, research institutions and public authorities can provide real case studies, internships, guest lectures, applied research topics and access to professional expertise. At the same time, joint courses, mobility, virtual exchanges, shared teaching materials and international project work can help students compare different national contexts and learn from European experience [22], [24], [28].

Future education in eco-mining and innovative natural resources management should also support the development of

soft skills and research competencies. Modern specialists need communication, teamwork, leadership, critical thinking, creativity, adaptability and the ability to explain professional decisions to different audiences. They should also be able to work with scientific literature, collect and analyse data, prepare reports, participate in research projects and present results.

Teaching methods should continue to move towards active and practice-oriented learning. Students should work with real or realistic professional tasks, including case studies, field data, laboratory work, digital simulations, project-based learning and cooperation with industry. Quality assurance should accompany these developments through clear learning outcomes, transparent assessment criteria, student feedback, regular programme review and involvement of teachers, students, employers and international partners.

The EMINReM project creates a strong basis for this modernization by supporting curriculum development, academic mobility, international cooperation, innovative teaching methods and the exchange of European experience. It encourages partner universities to rethink traditional approaches to mining education and include sustainability, digitalization, environmental protection and practice-oriented learning more systematically.

Thus, the future development of higher education in eco-mining and innovative natural resources management should be based on sustainability, circular economy, resource efficiency, water protection, waste management, occupational safety, environmental monitoring, digital technologies and international cooperation. In the long term, this will help prepare a new generation of professionals who understand that mining and resource management are not only technical activities, but also areas of environmental, social and economic responsibility.

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