

bridge between the invisible and the visible, enabling the consumer to engage with the fragrance on a conceptual and emotional level even before direct sensory interaction.

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INTERNATIONAL INTERNSHIPS AS A FACTOR IN THE PROFESSIONAL ADVANCEMENT OF ENGINEERS IN SECTORAL MECHANICAL ENGINEERING

Modern production processes are increasingly integrated into international supply chains and collaborative networks. This means that engineers can no longer rely solely on narrow technical expertise. Today they are expected to work effectively in multicultural teams, adapt quickly to new digital tools, and conduct professional communication in English. In Ukraine this trend is particularly evident: enterprises require specialists who not only operate modern equipment but also understand international production standards. In this context, international internships become a crucial element of professional development, as they allow students to combine theoretical knowledge with practical experience and to face the real demands of the global labor market.

International internships provide access to advanced technologies and methodologies, foster skills for working in modern production environments, and

promote the development of intercultural competence. Students gain the opportunity to familiarize themselves with equipment used in leading global companies and to observe how production processes are organized in different countries. This broadens their professional horizons, helps them understand employer expectations, and creates conditions for shaping their own career trajectory. Similar approaches are reflected in DAAD materials, where internships are presented as a way of gaining work-related experience, improving employability, and developing cultural awareness through practical experience abroad (DAAD, n.d.).

To ensure the systematic implementation of international internships in engineering education, a three-module model can be applied.

The Preparatory module should provide students with the necessary linguistic, intercultural, and technical background before the beginning of their mobility experience. This stage is important because students need to be ready not only for professional tasks but also for communication in an international academic or industrial environment. Therefore, the module may include courses in technical English, training in intercultural communication, and introductory seminars on partner technologies, institutional standards, and safety requirements.

The Practical module should focus on students' direct involvement in professional, technological, and research-oriented activities. At this stage, students may participate in production processes at enterprises, work in university laboratories, complete project-based assignments, and contribute to applied research. Such practical engagement allows students to connect theoretical knowledge with real engineering challenges and to develop professional competences that are difficult to form through classroom-based learning alone. This corresponds to the Erasmus+ approach to higher education mobility, which allows students to carry out traineeships in enterprises, research institutes, laboratories, organisations, or other relevant workplaces abroad (European Commission, 2023, p. 43).

The Recognition module should ensure the formal acknowledgement of the learning outcomes achieved during the internship. This module is necessary to make the results of international practical training visible within the academic programme and relevant for future employment. Recognition may be provided through the allocation of ECTS credits, certification of acquired skills, and inclusion of students' portfolios or project results in academic records. Erasmus+ also emphasizes that mobility activities should be supported by learning agreements and, wherever possible, integrated into the student's study programme, which confirms the importance of formal recognition of traineeship outcomes (European Commission, 2023, p. 57).

Despite the clear advantages, several obstacles remain. These include financial limitations for students and universities, insufficiently formalized agreements between academic institutions and enterprises, language and cultural difficulties, and inadequate preparation of students for independent work in an international environment. Additionally, some curricula do not fully correspond to the requirements of Industry 4.0, which refers to the integration of cyber-physical systems into manufacturing and logistics, as well as the use of the Internet of Things and Services in industrial processes (Kagermann, Wahlster, & Helbig, 2013). This mismatch complicates the integration of students into contemporary industrial and research environments.

To overcome these barriers, international internships should be more systematically integrated into engineering master's programmes. One possible solution is to include an *academic mobility module* in the curriculum either as a mandatory component or as an elective element, depending on the structure and objectives of the programme. Such integration would help ensure that international practical training is not treated as an additional or optional activity only, but as a meaningful part of professional competence development.

Another important step is the development of more *formalized cooperation agreements* between universities, enterprises, and international partner institutions. These agreements should clearly define the learning objectives of the internship,

expected outcomes, students' responsibilities, supervision mechanisms, and assessment criteria. This would make the internship process more transparent and would help align the expectations of academic institutions, industry partners, and students. The need for clear agreements is also supported by Erasmus+ requirements, according to which the sending and receiving organisations, together with students, should agree on the activities to be undertaken before the start of mobility through a learning agreement (European Commission, 2023, p. 48).

Financial support is also essential for making international internships accessible to a wider range of students. Universities should encourage students to use international grant opportunities, such as Erasmus+ and DAAD programmes, while also developing internal scholarship schemes or mobility funds. DAAD materials emphasize the role of internship-related funding programmes, including opportunities in science and engineering, while Erasmus+ provides structured mobility support for students at different study cycles, including traineeships abroad (DAAD, n.d.; European Commission, 2023, p. 50). Such support is particularly important because financial limitations often prevent students from participating in international mobility, even when academic or professional opportunities are available.

In addition, students should receive *targeted preparation* before departure. Preparatory courses in English, intercultural communication, and digital skills would help them adapt more effectively to international academic, research, or industrial environments. This preparation is especially relevant in engineering education, where students are expected to work with specialized terminology, digital tools, and multicultural project teams.

Finally, universities should introduce *systems for monitoring and evaluating* the long-term impact of internships on graduates' career development. This may include collecting feedback from students, supervisors, and employers, as well as tracking graduates' professional trajectories after completing international internships. Such

evaluation would make it possible to assess the real effectiveness of mobility programmes and to improve their structure in accordance with labour market needs and the requirements of modern engineering education.

International internships are a powerful tool for improving the quality of mechanical engineering education. They help students become more competitive, adapt to the demands of the global labor market, and integrate into international production processes. For universities, this raises prestige and opens new channels of cooperation with industry, while for regional economies it ensures the availability of qualified specialists capable of working according to modern standards.

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ARTIFICIAL INTELLIGENCE AS A KEY DRIVER OF DIGITAL TRANSFORMATION IN MODERN SOCIETY

In recent decades, digital technologies have become a fundamental part of social, economic, and engineering processes. Among these technologies, artificial intelligence (AI) occupies a central place due to its ability to analyze large amounts of data, automate processes, and support decision-making. The rapid development of AI significantly influences global challenges and creates new opportunities for innovation.