

Identification of gaps between digital and green education in EU and Balkans HEIs

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INTRODUCTION

The twin digital and green transition presents a major challenge for higher education institutions (HEIs) in the Western Balkans, which must align with EU priorities while addressing persistent structural and resource constraints. These challenges are particularly evident in strategic governance, curriculum design, digital pedagogy, green competency integration, and research and innovation capacity.

This paper analyses these gaps through comparative research conducted within the SKILL2SUSTAIN project, drawing on institutional mapping, EU good practices, and stakeholder survey findings. The analysis identifies priority areas for action and provides strategic recommendations to accelerate the digital and green transformation of higher education in the Western Balkans.

METHODOLOGY

The study uses a structured desk research approach, qualitative content analysis, and cross-dimensional benchmarking to compare digital and green education practices. Selected EU higher education institutions—UNS, UL, UZ, and UKIM—provide a reference framework for good practices, while WBC institutions—CEPS Kiseljak, UBL, UoM, UT, and PUT—are assessed in terms of their current capacities and institutional needs.

The analysis focuses on seven dimensions: strategic governance, curriculum and skills, digital teaching and learning, green transition, research and innovation, lifelong learning, and industry links. By comparing EU practices with WBC realities and validating the findings through SKILL2SUSTAIN stakeholder surveys, the study identifies key gaps in skills, institutional capacity, digital infrastructure, and cooperation with industry and other stakeholders.

GAP ANALYSIS

The gap analysis identifies significant differences between EU and WBC higher education institutions. While WBC HEIs increasingly recognise digital and green transformation as strategic priorities, implementation remains fragmented, project-driven and concentrated at programme or faculty level, with limited interdisciplinary curricula, uneven digital infrastructure, and weaker integration of green competencies across disciplines.

In contrast, EU HEIs demonstrate more systematic, institution-wide approaches supported by integrated governance structures, advanced digital ecosystems, interdisciplinary curricula, harmonised green competencies, and stronger research and innovation networks. Overall, the findings indicate that WBC institutions have strong potential and relevant local initiatives, but require greater institutional integration, advanced digital and green skills provision, sustainable funding mechanisms, and stronger industry and innovation links to move from project-based transformation towards systemic digital and green transformation.

DIMENSION	WBC HEIs – CURRENT STATE	EU HEIs – CURRENT STATE	NATURE OF GAP	BRIDGING PATHWAYS
 1. Strategic Orientation	• Project-driven • Fragmented governance • Limited cross-faculty integration	• Systemic approach • Long-term roadmaps • Embedded in governance, budgeting, reporting	 Institutional maturity and permanence	 Establish RECs, interoperable platforms, cross-faculty governance structures
 2. Curriculum Design	• Uneven integration • Strong in MSc/PhD engineering • Weak at bachelor level and in social sciences	• Modular, interdisciplinary • Competence-based • Systematic across all levels and disciplines	 Integration depth and disciplinary breadth	 Introduce hybrid modules, interdisciplinary design, early bachelor exposure
 3. Digital Learning	• Tools and delivery focus • BIM, GIS, simulation • Program-specific use	• Pedagogical transformation • AI, VR/AR, digital twins • Learning analytics	 Innovation level and pedagogy transformation	 Invest in advanced digital tools, standardize digital pedagogy frameworks
 4. Green Integration	• Program-level integration • Strong in engineering • Limited in economics, social sciences	• Institution-wide integration • Harmonized green competencies • Embedded in governance and campus operations	 Structural embedding and institutional scope	 Harmonize green competencies; extend beyond engineering; integrate campus operations
 5. Research & Innovation	• Applied, regional focus • Capacity-building orientation • Moderate funding (€42k–€837k)	• Deep-tech and high-impact • Multi-million Horizon projects • Technology transfer & spin-offs	 Innovation scale and commercialization	 Strengthen R&I intensity, IP management, deep-tech partnerships
 6. Lifelong Learning	• Courses with ECTS (CEPS, UPT) • Limited scope and recognition	• Micro-credentials ecosystem • Widely recognized • Linked to industry needs	 Recognition, scalability and stakeholder access	 Develop micro-credentials, link to EU competency frameworks
 7. Stakeholder Engagement	• Operational engagement • KHCS/KVC hubs • Applied cooperation with SMEs and public sector	• Strategic co-creation • Embedded in R&I governance • Strong policy and industry linkages	 Governance integration and strategic scope	 Integrate stakeholder needs into strategy, monitoring, and co-design processes

Figure 1. Gap synthesis across analytical dimensions

STRATEGIC RECOMMENDATIONS

Bridging the identified gaps requires WBC HEIs to move from **initiative-based reform towards system-based digital and green transformation** by integrating sustainability and digitalisation into governance, funding, curricula, infrastructure, research, and lifelong learning. EU partnerships through SKILL2SUSTAIN can accelerate this process through capacity building, knowledge exchange, and coordinated digital-green initiatives.

In the **short term (6–18 months)**, institutions should map existing strategies, establish cross-faculty coordination, introduce hybrid digital-green modules, pilot AI/BIM/GIS tools, harmonise green competencies, and develop targeted micro-credentials. Stakeholder skills needs should also be regularly collected and incorporated into curriculum development.

In the **medium term (18–36 months)**, these initiatives should become permanent institutional practices through integrated budgeting, quality assurance, interdisciplinary curricula, standardised digital pedagogy, virtual laboratories, and institution-wide green transition measures. Research and innovation capacity should also be strengthened through larger EU projects, industry partnerships, technology transfer, and commercialisation.

Overall, **joint training, co-designed micro-credentials, living labs, and public-private innovation workshops** represent high-impact mechanisms for connecting HEIs with industry and public institutions. These actions can help ensure that education and training respond effectively to emerging digital and green skills needs.

CONCLUSIONS

This paper presents a gap analysis of digital and green education in EU and Western Balkan HEIs across five dimensions: strategic orientation, curriculum design, digital pedagogy, green transition, and research and innovation. The findings show that WBC HEIs are aligned with EU priorities but face structural challenges, including fragmented governance, limited funding, uneven digital infrastructure, and insufficient interdisciplinary and green competency integration.

Bridging these gaps requires a shift from project-driven to system-driven transformation, supported by stronger EU-WBC cooperation, institutional capacity building, and stakeholder engagement. The SKILL2SUSTAIN project provides a foundation for this transition through co-designed training, micro-credentials, and strengthened research and innovation ecosystems.