Twin Transition – Understanding the Why and Building the How

Webinar Background Note

Community for Educational Innovation - CEI

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BACKGROUND NOTE

Twin Transition: Understanding the Why and Building the How

Thematic Strand 3: Education for Green and Digital Innovation

The Community for Educational Innovation (CEI) webinars bring together education, research, industry, civil society and public sector stakeholders to share good practices and discuss innovation in education. These sessions focus on strategic competence development to boost student success and advance education and training systems, aligning with the Communication of the European Commission on the Union of Skills.

This document outlines the background and key questions for the webinar 'Twin Transition: Understanding the Why and Building the How' on 05 March 2026.

The term twin transition refers to the coupling of two transformation trends reshaping institutions, societies and economies: the green and digital transitions. The green transition "refers to the fundamental shift in production and consumption patterns to allow us to live within planetary boundaries."[1] It implies "mitigating climate change by introducing climate-friendly lifestyles and taking environmental costs into account."[2] The digital transition "consists of all processes at all levels in society involving infrastructure, services, applications and human behaviour that depend on a digital representation of knowledge and computer power."[3]

Instead of running in parallel, the green and digital transitions are considered 'twinned', a framing that underscores their simultaneity and the necessity of pursuing them together. As research emphasises, "the ongoing and comprehensive digital transition of society can and must contribute towards the green transition, but the digital transition itself must also become greener."[4] Achieving this integration is significant since "successfully managing the green and digital 'twin' transitions is the cornerstone for delivering a sustainable, fair, and

[1] Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M., & Scapolo, F., *Towards a green and digital future: Key requirements for successful twin transitions in the European Union*, Publications Office of the European Union, 2022, p. 8, https://doi.org/10.2760/977331

[2] Ibid.

[3] Dæhlen, M., *The Twin Transition Century: The role of digital research for a successful green transition of society?* The Guild, 2023, p.5, https://doi.org/10.48350/184458

[4] Ibid.

competitive future."[5]

In this context, education and training can act as a hub for innovation and as an intermediary that bridges stakeholders to drive the twin transition. "Education is the key to bringing these transitions into harmony and confluence," shaping a 'new kind of citizenship' committed to harnessing digital power and environmental sustainability.[6] For example, universities serve as critical places for research and innovation in areas such as energy-efficient technologies, smart agriculture, and circular economy solutions, while also cultivating the skills future workers need to navigate the green and digital demands. This requires education to move beyond incremental adaptation towards strategic transformation, integrating sustainability and digital literacy across their research, teaching, and collaboration capabilities with industry, government and society.[7]

The policy framework of the twin transition

The European Union (EU) has established an ambitious policy architecture to drive the twin transition at the heart of its strategic agenda. The twin transition policy framework is anchored in two pillars:

- **The European Green Deal**,[8] launched in 2019, is a roadmap to make Europe the first climate-neutral continent by 2050. This strategy reframes environmental action as a sustainable growth strategy, aiming to decouple economic growth from resource use while ensuring competitiveness through the circular economy and resource efficiency. Within this framework, the EU has adopted the *European Climate Law*,[9] which makes the target of net-zero greenhouse gas emissions by 2050 legally binding and sets an ambitious 2030 target.
- The strategy **Shaping Europe's Digital Future**[10] and the **2030 Digital**

[5] Muench et al, p. iv.

[6] Giannini, S., Bridging the green and digital transitions through education. UNESCO, 2024, p. 1, https://doi.org/10.54675/ZACQ4808

[7] Kyawt Ni, A., The Twin Transition Strategy Framework: How Universities Can Effectively Leverage Their Capabilities In Research, Teaching, And Collaborations, Community Notebook. People, Education and Welfare in the Society 5.0, 1(4), 2025, https://doi.org/10.61007/QdC.2025.2.385

[8] Communication on the European Green Deal, COM(2019) 640 final, 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52019DC0640

[9] European Union, Regulation 2021/1119—Framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), 9.7.2021, https://eur-lex.europa.eu/legal-content/%20en/TXT/?uri=CELEX%3A32021R1119

[10] Communication on Shaping Europe's digital future, COM(2020) 67 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52020DC0067

Compass[11] are the digital pillar. They establish targets for digital skills, infrastructure, and the digital transformation of businesses and public services. Digital technologies are positioned as essential enablers for reaching the Green Deal objectives, with specific initiatives like 'Destination Earth'[12] and local 'Digital Twins'[13] designed to simulate environmental impacts and optimise resource management. The framework emphasises that the digital transition must be human-centred and secure to empower citizens and businesses

A critical evolution in the framework occurred with the *2022 Strategic Foresight Report*,[14] which focused on 'twinning' the green and digital transitions within a new geopolitical context. This report shifted the narrative from two parallel trends to an integrated management approach intended to reinforce synergies and address tension points, such as the environmental footprint of digital infrastructure. This alignment is furthered by the *New Industrial Strategy for Europe*[15] and the *Green Deal Industrial Plan for the Net-Zero Age*,[16] which seek to boost the EU's competitive sustainability by integrating digital power into industrial decarbonisation and clean-tech manufacturing.

The implementation of these goals is driven by the *Recovery and Resilience Facility (RRF)*,[17] the core of the NextGenerationEU[18] recovery plan. To access these funds, EU Member States are required to develop *National Recovery and Resilience Plans*[19] that allocate at least 37% to 40% of funding to green objectives and at least 20% to

[11] Communication on the 2030 Digital Compass: the European way for the Digital Decade, COM(2021) 118 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52021DC0118

[12] Destination Earth (DestinE) is a flagship European Union initiative launched in 2022 to develop a highly accurate digital replica (digital twin) of the Earth system by 2030, aiming to revolutionise environmental monitoring. https://destination-earth.eu/

[13] Digital Twins are virtual representations of the real world that, for example, enable more efficient innovation development or the optimisation of processes. European Commission, *2020 Strategic Foresight Report: Charting the course towards a more resilient Europe*, 2020, https://commission.europa.eu/strategy-and-policy/strategic-foresight/2020-strategic-foresight-report_en

[14] Communication on the 2022 Strategic Foresight Report: Twinning the green and digital transitions in the new geopolitical context, COM(2022) 289 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0289&qid=1658824364827

[15] Communication on A New Industrial Strategy for Europe, COM(2020) 102 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52020DC0102

[16] Communication on A Green Deal Industrial Plan for the Net-Zero Age, COM(2023) 62 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52023DC0062

[17] European Commission, *Recovery and Resilience Facility (RRF)*, https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en

[18] European Commission, NextGenerationEU, https://next-generation-eu.europa.eu/index_en

[19] European Commission, *Recovery and Resilience Plans*, https://reform-support.ec.europa.eu/what-we-do/recovery-and-resilience-plans_en

digital transformation. Additionally, the REPowerEU[20] plan was introduced in 2022 to accelerate the energy transition in response to geopolitical dependencies on fossil fuels.

To ensure the framework is inclusive, the EU established the *Just Transition Mechanism (JTM)*[21] and the *Just Transition Fund (JTF)*,[22] which provide financial support and reskilling programmes for regions and workers most affected by the move away from carbon-intensive industries. The *European Skills Agenda*[23] and the *Pact for Skills*[24] complement this by focusing on upskilling the workforce for 'twin jobs' that require digital and green competencies. Additionally, initiatives such as the *Erasmus+ Centres of Vocational Excellence (CoVE)*[25] and the *Union of Skills*[26] promote bottom-up approaches to developing the specialised skills needed for an innovative, inclusive and sustainable economy.

Twin transition in education

Education provides the competences, critical thinking, and values needed to transition from a 'brown-economy' model to a green-growth trajectory.[27] Education is essential for skilling, upskilling and reskilling the workforce, ensuring that the labour market is equipped for 'twin jobs' requiring digital and green competences. Furthermore, education shapes a 'new kind of citizenship' which cultivates the systems thinking and values required in digital and sustainable societies.[28]

The requirements for education in this context include a strategic transformation of the curricula and core missions rather than mere adaptation. At the curricular level, education can align with:

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[20] European Commission, *REPowerEU,* https://commission.europa.eu/topics/energy/repowereu_en

[21] European Commission, *The Just Transition Mechanism: making sure no one is left behind,* https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

[22] European Commission, Just Transition Fund, https://ec.europa.eu/regional_policy/funding/just-transition-fund_en

[23] Communication on a European Skills Agenda for sustainable competitiveness, social fairness and resilience, COM/2020/274 final, EUR-Lex - 52020DC0274 - EN - EUR-Lex

[24] European Commission, *Pact for Skills,* https://pact-for-skills.ec.europa.eu/index_en

[25] Erasmus+ Programme Guide, Centres of Vocational Excellence (CoVE), https://erasmus-plus.ec.europa.eu/programme-guide/part-b/key-action-2/centres-vocational-excellence

[26] Communication on the Union of Skills, COM(2025) 90 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0090

[27] ST4TE Project, *Review of green, digital and twin transition policies*, 2024, https://st4te.eu/sites/default/files/2025-03/ST4TE_D1.1.pdf

[28] Giannini, 2024, p. 1.

- **GreenComp**,[29] the *European Sustainability Competence Framework*, defining the knowledge, skills, and attitudes needed for sustainability. It identifies key competence and skill development across four areas: Embodying Sustainability Values, Embracing Complexity in Sustainability, Envisioning Sustainable Futures, and Acting for Sustainability.
- **DigComp**,[30] the *Digital Competence Framework* defining digital skills for citizens. It identifies key elements for skills development across 5 areas: Information and Data Literacy, Communication & Collaboration, Digital Content Creation, Safety, and Problem Solving.

Research can drive the twin transition across a comprehensive disciplinary spectrum. In engineering, research contributes to developing energy-efficient algorithms, AI models, smart grids, and neuromorphic computing to mitigate the massive energy consumption of digital infrastructure. In the natural sciences, it contributes through green chemistry, sustainable materials, solar panels and batteries. In agriculture, it contributes to precision farming, resilient food systems, and the use of Digital Twins to optimise resource use and monitor soil health in real time. In the social sciences and humanities, it fosters behavioural change and circular-economy business models and provides critical perspectives and ethical frameworks to ensure that technological advancements remain human-centred and socially acceptable.

Education also drives knowledge valorisation by serving as an 'honest broker' that translates transdisciplinary research into tangible societal and economic value.[31] By facilitating knowledge and technology transfer, institutions turn research into practical applications for a climate-neutral future. This process is also bolstered by evidence-based policy recommendations that guide government decision-making, ensuring that the twin transition remains grounded in scientific rigour.

Furthermore, educational institutions are required to transform their operations through sustainability plans with metrics.[32] This requires enhancing capacities to rationalise computing power by implementing data strategies that minimise energy consumption and the use of active storage media. To green their digital infrastructure, institutions locate high-performance facilities near renewable

[29] Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M., *GreenComp: The European sustainability competence framework*, Punie, Y. and Bacigalupo, M. editor(s), Publications Office of the European Union, 2022, https://dx.doi.org/10.2760/13286

[30] Cosgrove, J. and Cachia, R., *DigComp 3.0: European Digital Competence Framework - Fifth Edition*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2760/0001149

[31] Kyawt Ni, 2025.

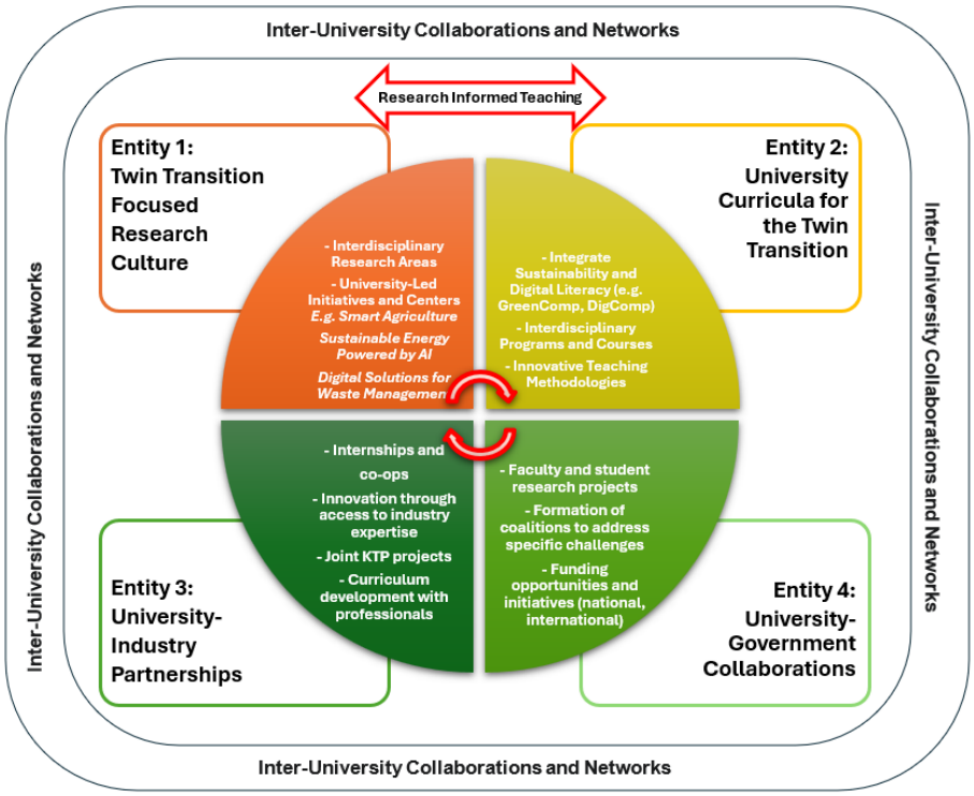
[32] Dæhlen, 2023, p.5.

energy sources and implement systems to reuse surplus heat for campus heating. Furthermore, they establish protocols for the disposal of digital waste and the recycling of rare minerals from obsolete equipment.

Conceptualising the twin transition in higher education, Professor Kyawt Ni's developed the Twin Transition Strategy Framework (Figure 1).[33] It is a conceptual model designed to help universities integrate green and digital transformations into their strategies. It leverages four dimensions and requires:

- Driving the transition through interdisciplinary science and the transfer of knowledge in fields like smart agriculture and energy-efficient AI.
- Modernising curricula using the GreenComp and DigComp frameworks while implementing challenge-based learning and immersive technologies like virtual reality.
- Establishing strategic partnerships with industry and government to facilitate knowledge transfer, co-create evidence-based policies, and leverage interdisciplinary science to address complex challenges.
- Fostering inter-university collaborations and networks is a strategic initiative to accelerate the twin transition by enabling institutions to collectively share knowledge, resources, and best practices.

Figure 1. Twin Transition Strategy Framework



[33] Kyawt Ni, 2025.

Source: Kyawt Ni, *The Twin Transition Strategy Framework: How Universities Can Effectively Leverage Their Capabilities In Research, Teaching, And Collaborations*, 2025.

Challenges in supporting the twin transition

Supporting the twin transition for education involves navigating diverse strategic uncertainties, structural inequalities, and inherent tensions between digital advancement and environmental sustainability. Key challenges include:

- **Strategic uncertainty and evolving skill demands**: Educational providers face difficulty in predicting future labour needs because, "given the scale and speed of change, it is difficult to predict what types of skills will be in demand and how best to create them."[34] This strategic uncertainty affects all stakeholders, as it is currently unclear how best to create training that accounts for such rapid transitions. Furthermore, current technical documents note that there is "not a fixed definition of what exactly these skills are, as technologies, requirements, regulatory standards continuously evolve."[35]
- **Curricular and pedagogical inertia**: Traditional academic structures are often unsuited for these challenges, as "traditional teaching may not suffice for the twin transition's multifaceted challenges".[36] Educational programmes should transition to participatory approaches to go beyond simply conveying knowledge and instead promote active engagement. This requires overcoming the "logic of limits" in sustainability versus the "logic of limitless growth" inherent in many digital frameworks.[37]
- **The environmental footprint of educational infrastructure**: The widespread adoption of digital tools carries high environmental costs that can conflict with institutional sustainability goals. Specifically, "laptops, tablets and other hardware essential for modern education are highly resource-intensive to produce," with production often accounting for 80% of a device's total energy consumption.[38] Furthermore, the accumulation of e-waste is growing five

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[34] Graf, L., Marques, M., and Lambrechts, A., *Skills Development for the Twin Transition: Building Transnational Skills Ecosystems Through Experimentalist Governance*, Regulation & Governance, 2025, p. 1, https://doi.org/10.1111/rego.70076

35 ST4TE Project, 2024, p. 13.

36 Aloisi, A., The EU's 'twin' green and digital transitions: A policy revolution, or just Euro-jargon? The Conversation, 25 February 2025, https://theconversation.com/the-eus-twin-green-and-digital-transitions-a-policy-revolution-or-just-euro-jargon-250459

37 Kyawt Ni, 2025, p. 138.

38 Giannini, 2024, p. 5.

times faster than recycling rates, creating a literal "chain of discarded phones, laptops, [and] computer screens".[39]

- **Exacerbation of the green and digital divide**: There is a major risk that the transitions will widen existing social gaps, creating "new layers of cumulative and intertwined inequalities, with conflicting dimensions appearing over different time horizons and geographical areas".[40] The green and digital divides could slow overall progress in reducing income inequality and improving employment quality, widening the gap between individuals, regions, and social groups. Data shows that these transitions are 'not distributionally neutral,' as "women remain disproportionately concentrated in the lower income deciles" and younger workers face significant generational divides.[41]
- **Policy fragmentation and silo approaches**: A major obstacle is that policies are frequently developed within siloed frameworks, for example, being conceptually isolated with limited interactions among the transitions. Research suggests that "most policy documents display a limited understanding of the complex interdependencies, synergies, and trade-offs" between the two transitions, leading to "fragmented implementation tools and strategies."[42] This calls for adopting integrated strategies for the twin transition.

Webinar Twin Transition – Understanding the Why and Building the How

This webinar will explore the synergies and challenges between digital transformation and sustainability in education. Key questions guiding the discussion will include:

- What approaches can institutions adopt to anticipate future skill needs when the twin transition evolves faster than traditional curriculum cycles?
- How can universities embed green and digital goals across operations, governance, and campus infrastructure in a coherent way?
- How can institutions organise interdisciplinary research to address twin

39 Ibid.

40 ST4TE Project, 2024, p. 7.

41 ST4TE Project, *The impact of twin transition on income inequality and employment quality*, 2024, p. 50, https://st4te.eu/sites/default/files/2025-12/D2.2.%20The%20impact%20of%20twin%20transition%20on%20income%20inequality%20and%20employment_0.pdf

42 ST4TE Project, 2024, p. 39.

transition challenges while ensuring findings translate into societal impact?

This webinar is part of the 'Thematic Strand 3: Education for Green and Digital Innovation.' It also includes the webinars Educating to Thrive in the Digital World (April 29, 15:30 CET) and Leading Sustainability in Education (June 10, 15:30 CET).