Twin Transition – Understanding the Why and Building the How

Webinar Summary

Community for Educational Innovation - CEI

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Twin Transition – Understanding the Why and Building the How

Thematic Strand 3: Education for Green and Digital Innovation

The twin transition promises a future that is both sustainable and digital. But the path there is uneven, challenging, and full of trade-offs. This summary explores three perspectives on why integration matters, where the gaps are, and what higher education institutions must do to become genuine agents of a just transition.

Presentation 1: Towards a green and digital future: Key requirements for successful twin transitions in the European Union

By Stefan Muench, Head of Science Insights, Joint Research Centre (JRC).

This presentation introduced the twin transition as the combined transformation driven by digital technologies and the transition towards environmentally sustainable economies. The analysis builds on the report 'Towards a green & digital future – Key requirements for successful twin transitions in the European Union',[1] conducted by the Joint Research Centre to support the European Commission's strategic foresight work. Using foresight methodologies such as trend analysis and backcasting, the research examines how Europe can achieve long-term sustainability goals, including climate neutrality by 2050, how digital technologies can support the green transition, and where there are tension points between the two transitions.

The presentation highlighted five sectors where the interaction between digital and green transitions is particularly important: energy systems, mobility and transport, construction, agriculture and energy-intensive industries. In these sectors, digital technologies can improve monitoring systems, enable predictive modelling, and support more efficient resource management, among other benefits. The presentation emphasised that achieving successful twin transitions requires coordinated action across several dimensions.

Key requirements for achieving successful twin transitions:

— **Social:** Ensure just transitions; increase societal commitment to the need for change, ensure privacy and ethical use of technology.

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[1] Towards a green & digital future – Key requirements for successful twin transitions in the European Union, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2760/977331

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- **Technological:** Implement innovative infrastructure, build a coherent and reliable technological ecosystem, and ensure data availability and security.
- **Environmental:** Avoid rebound effects, reduce the environmental footprint of green and digital technologies.
- **Economic:** Create enabling markets; ensure diversity of market players, equip labour with relevant skills.
- **Political:** Implement adequate standards; ensure policy coherence, channel investments into green-digital solutions.

Stefan Muench concluded his presentation by emphasising the need for continued research on how to effectively implement the twin transition. He highlighted that developing stronger links between digital and green innovations requires carefully balancing their benefits and potential drawbacks. The speaker also highlighted the importance of frugal innovation, encouraging a more strategic use of digital technologies that deliver the greatest added value to sustainability goals. Finally, he noted that addressing the challenges of the twin transition requires transdisciplinary research and collaboration, bringing together expertise from different fields to develop solutions that support both technological progress and environmental sustainability.

Presentation 2: Twinning green and digital without widening gaps: A place-based framework from ST4TE

By Christina Kakderi, Associate Professor of Spatial Development and Innovation Systems, Aristotle University of Thessaloniki; Coordinator, Horizon Europe project ST4TE.

Christina Kakderi presented findings from the Horizon Europe project ST4TE (Strategies for Just and Equitable Transitions in Europe),[2] which examines how the green and digital transitions are affecting inequalities across European regions. The presentation offered a place-based diagnostic lens across three layers of asymmetry, integrating macro-level regional mapping, occupational data, and results from 402 in-depth qualitative interviews across Europe. The central argument was that, unless addressed proactively, the twin transition risks reproducing rather than reducing existing territorial and social divides.

Layer 1: Uneven Spatial Capacity - The Geography of Advanced Training

European higher education is broadly accessible, but doctoral training and advanced research capacity remain highly concentrated in a small number of

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[2] ST4TE (Strategies for Just and Equitable Transitions in Europe), https://st4te.eu/

research-intensive regions, predominantly in Central and Western Europe. PhD students and graduates cluster in these 'super-regions,' meaning that the capability to generate frontier knowledge for the twin transition is geographically imbalanced. This is further compounded by uneven research ecosystems: frontier research capacity (measured by European Research Council grants) is highly concentrated, while university-industry collaboration is more diffuse but still imbalanced towards innovation-intensive economies. This creates a layered university landscape, where some institutions primarily widen access to education and others anchor high-end knowledge creation and research-led regional development.

Layer 2: Uneven Access to Opportunities - Green and Digital Jobs Follow Different Regional Pathways

Green jobs are broadly distributed across skill levels and geographically dispersed, though they tend to be lower- and medium-skilled in Southern and Eastern Europe. Digital jobs, by contrast, are more skill-selective and spatially concentrated in metropolitan and innovation-intensive regions. Twin jobs, occupations combining both green and digital competences, do not erase this divide but rather recombine it: high-skilled twin jobs cluster in Northern and Western Europe, while lower- and medium-skilled twin jobs prevail in parts of the South and East. Kakderi also highlighted the concept of 'enabling occupations,' administrative, managerial, and technical support roles that facilitate technology adoption, as a key dimension that higher education institutions must support beyond preparing graduates for core twin roles.

Layer 3: Uneven Lived Experiences - Choice vs. Compulsion

Beyond labour market structures, Kakderi presented evidence on how the green and digital transitions are experienced differently. Digital exposure is concentrated in higher-income occupations, while green exposure is more broadly distributed across income deciles. Work-from-home access and job security similarly favour higher-income workers. At the level of lived experience, the green transition tends to be perceived as a value-driven choice, whilst the digital transition is more often experienced as compulsion, a fast-moving, inescapable pressure. The ST4TE findings draw on deliverables and milestones available at st4te.eu.[3]

Implications for Universities

Kakderi concluded by arguing that universities must fulfil three roles in the context of the twin transition: as capability pipelines, widening access to higher education

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[3] All outputs available at: https://st4te.eu/project-outputs

including micro-credentials, reskilling, and lifelong learning; as regional anchors, especially in weaker regions, connecting local labour markets, firms, public actors, and place-based development needs; and as transition translators, connecting ambitious transition goals to usable local pathways across curricula, partnerships, and regional missions. A just twin transition, she argued, requires universities that distribute capabilities more widely and make participation more inclusive across people and places.

Presentation 3: When Machines Think, the Planet Shouldn't Pay

By Morten Dæhlen, Professor, Department of Informatics, University of Oslo; Co-Director, The Norwegian Centre for Trustworthy AI (TRUST)

Morten Dæhlen framed artificial intelligence as sitting at the core of the twin transition challenge, simultaneously a major environmental burden and a potential catalyst for the green transition. His presentation drew on the report 'The Transition Century: The role of digital research for a green transition of society?'[4] and the article 'When Machines Think, the Planet Shouldn't Pay.'[5]

The Physical Reality of Artificial Intelligence

Dæhlen urged participants to reckon with the material infrastructure underlying AI. The extraction of critical minerals for hardware components draws on ecologically vulnerable regions, often in the Global South, raising concerns about environmental harm and conflict minerals. Data centres require vast quantities of fresh water for cooling, in contexts where water scarcity is already acute. Most significantly, AI systems account for an estimated 2% of global electricity consumption, and growing baseload demand from data centres risks delaying investment in renewable energy infrastructure, creating a direct tension between the digital and green transitions. Dæhlen also noted the use of AI by oil and gas companies to optimise extraction operations as a further complication.

Technology and Governance Pathways to Sustainable AI

Dæhlen outlined two complementary sets of pathways to address the environmental costs of AI. On the technology side, he pointed to: a shift from large to small models and edge intelligence; neuromorphic and optical computing approaches; and data reduction, refinement, and sharing. On the governance side,

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[4] Dæhlen, M. (2023), *The Transition Century: The role of digital research for a successful green transition of society*, The Guild Insight Paper 5, https://www.the-guild.eu/publications/insight-papers/the-guild_insight-paper_the-twin-transition-century_sept-2023.pdf

[5] Dæhlen, M. (2026), *When Machines Think, the Planet Shouldn't Pay*, https://www.titan.uio.no/blogg/morten-daehlen/2026/when-machines-think.html

he called for AI-aware ESG (Environmental, Social and Governance) frameworks; standardised metrics and KPIs for the environmental impact of AI products; policies that prioritise planetary health alongside human needs; and a comprehensive digital resource taxation system to internalise the environmental costs of data.

AI as a Catalyst for the Green Transition

Despite these risks, Dæhlen argued that AI holds substantial catalytic potential for the green transition. Applications include smarter energy grids enabling renewable integration, precision agriculture reducing waste, mobility reinvention, preventive healthcare systems, proactive ecosystem stewardship, new materials discovery for energy efficiency, and AI as a force multiplier for scientific discovery. The overarching, unresolved question he posed was whether AI could decouple economic growth from the overuse of Earth's resources. Dæhlen closed by presenting the TRUST Centre's framework for trustworthy AI, which positions sustainability, green AI for the green transition, as one of seven core dimensions of trustworthiness, alongside accuracy, safety, explainability, fairness, governance, and scalability.[6]

Key takeaways

— **Synergy, not parallelism.** Despite an extensive EU policy framework on twin transition, the green and digital policy streams still largely run in parallel rather than as one integrated agenda. Speakers underlined the need for transdisciplinary research, curricula integration, and institutional strategies that treat the two transitions as genuinely interdependent.

— **Equity is a structural, not incidental, challenge.** The distribution of twin transition opportunities is uneven across territories and social groups. Advanced research capacity is concentrated, digital jobs are skill-selective and spatially clustered, and the rewards of transition-linked work are stratified. Addressing this requires not only broad access to higher education but also a wider territorial distribution of research capacity and deliberate inclusion policies.

— **AI is both a problem and a solution for the green transition.** The material environmental costs of AI, in minerals, water, and energy, are real and risk delaying the green transition. Addressing them requires simultaneous action on technology (smaller models, neuromorphic computing, data reduction) and governance (ESG frameworks, KPIs, taxation). Yet AI's catalytic potential for sustainability applications is equally substantial.

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[6] TRUST — The Norwegian Centre for Trustworthy AI, https://www.trust-aicentre.no/english/

— **Universities are central to making the twin transition work.** All three presentations converged on the role of higher education institutions as capability pipelines, regional anchors, and transition translators. This includes reskilling through micro-credentials, supporting enabling occupations, and connecting institutional research and teaching strategies to regional development needs.

— **What participants prioritised.** A Mentimeter poll on embedding the twin transition in education produced the following ranking: training educators in green and digital competencies (29%); redesigning curricula around GreenComp and DigComp frameworks (19%); adopting challenge-based and interdisciplinary teaching methods (19%); engaging students in regional green and digital initiatives (14%); aligning institutional research, teaching, and operations around a coherent twin transition strategy (10%).

— **Global dimensions of the twin transition.** Participants raised the risk of burden-shifting to the Global South through mineral extraction and data colonialism. The discussion acknowledged that equity must be addressed globally, not only within the EU, and that AI governance frameworks must actively resist the reproduction of Global North worldviews in model design and deployment.

Upcoming Activities

— **Next webinar:** '[Educating to Thrive in the Digital World](#)', 29 April 2026
— **Call for Good Practices:** Share initiatives or policies [on Education for Green and Digital Innovation](#).
— **Thematic Strand 2 Report,** "From Research to Impact — Bridging the Innovation Gap in Higher Education", will be published in March 2026.
— **Study visit:** New Bulgarian University, Sofia, July 2026/