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TVET@Asia Issue 27: Greening TVET for Sustainable Development

The transition towards environmentally sustainable, low-carbon, and resource-efficient economies has become one of the defining challenges of our time. Climate change, environmental degradation, and the growing demand for sustainable production and consumption are reshaping economies, industries, and labour markets worldwide. These developments place new demands on Technical and Vocational Education and Training (TVET), which plays a crucial role in preparing individuals for changing occupational requirements and supporting sustainable economic and societal development (Cedefop & UNESCO-UNEVOC, 2025).

However, greening TVET extends beyond the integration of environmental knowledge and green skills into vocational curricula. It requires a broader transformation of education and training systems, encompassing institutional governance, teaching and learning approaches, teacher education, industry collaboration, and the relationship between skills development and labour market opportunities. Moreover, the transition towards greener economies raises important questions concerning social inclusion, equitable access to training, and the quality and sustainability of emerging employment opportunities (GIZ, 2022).

Against this background, Issue 27 of TVET@Asia, Greening TVET for Sustainable Development, brings together five contributions examining different dimensions of greening TVET. The articles address curriculum and policy alignment, innovative pedagogical approaches, stakeholder collaboration, teacher education, and the relationship between green skills development and sustainable employment. Together, they highlight both the opportunities and the structural challenges associated with positioning TVET as a driver of sustainable development.

1 Overview of the Contributions

The first contribution, *"Curriculum, Policy, and Gap Analysis of Green Skills Integration in Technical and Vocational Education and Training in the Philippines,"* RAY BUTCH MAHINAY, SHIELA MAE SEGUMPAN, CHARLIE COSMIANO & JACKIELYN ABAO, examines the extent to which green skills are integrated into curriculum frameworks and national education policies in the Philippines. Drawing on Pavlova's Generic Green Skills Framework, the study analyses sustainability competencies across different levels of the Philippine education system. The findings reveal a notable gap between policy ambitions and their integration into curricula, particularly regarding systems thinking competencies. The

article highlights the importance of stronger policy alignment, curriculum coherence, and coordinated reforms to translate national sustainability objectives into educational practice.

Building on the importance of curriculum integration, the second article, CHIBUEZE TOBIAS ORJI & JULIET PERUMAL, *"Integrating Green Competencies in TVET: An Integrative Review of Inclusive Digital Pedagogies for Addressing Skills Development Challenges,"* explores how digital teaching and learning approaches can support the development of green competencies. Based on an integrative review of 34 studies, the contribution identifies the potential of online and blended learning, simulations, immersive technologies, and artificial intelligence-supported pedagogies for sustainability-oriented skills development. At the same time, it identifies important research gaps concerning teacher capacity building and the recognition of green credentials. The article thus draws attention to the need for pedagogical innovation that is not only technologically advanced but also inclusive and accessible.

While curriculum and pedagogical reforms are essential, greening TVET also depends on effective cooperation between education systems and wider societal stakeholders. The third contribution, TAWANDA CHINENGUNDU, *"Quadruple Helix Model in TVET Collaboration for Green Jobs in the Global South: A Systematic Review,"* examines the potential of collaboration between government, industry, academia, and civil society to support green skills development and employment. The review identifies the benefits of multi-stakeholder collaboration while highlighting persistent challenges related to institutional coordination, funding, and stakeholder participation. In particular, the limited involvement of civil society raises questions about the inclusiveness and local responsiveness of green TVET initiatives. The article emphasises the importance of context-sensitive governance and collaborative structures in supporting sustainable transitions, particularly in the Global South.

The fourth article, ANUSUYA KALIAPPAN, HASHIMA HAMID & ASMAH BOHARI, *"Bridging Curriculum and Industry: A Framework for Integrating Green Competency in Malaysia TVET Teacher Education,"* focuses on the role of teacher education in aligning TVET curricula with emerging green industry requirements. Using the Fuzzy Delphi Method, the study identifies and validates key elements for integrating green competencies into TVET teacher education. Green technology knowledge, problem-solving and analytical competencies, innovative teaching methods, and green principles emerge as particularly important dimensions. The contribution offers a framework for curriculum development and underscores the central role of teacher educators in translating sustainability objectives and industry requirements into effective educational practices.

The fifth contribution, ANJANA RAJAGOPALAN & RAKESH RANJAN KUMAR, *"From Green Skills to Sustainable Livelihoods: Repositioning TVET in India's Informal Green Economy,"* introduces a critical labour market perspective. Focusing on renewable energy, electric mobility, e-waste management, and green construction in India, the article examines the relationship between green skills development and employment opportunities in informal

and fragmented labour markets. It highlights a *green skills–employment paradox*: while training systems increasingly respond to the demand for green competencies, the creation of stable, inclusive, and sustainable employment opportunities remains limited. The article challenges the assumption that expanding green skills training necessarily leads to improved employment outcomes and emphasises the importance of employment quality, social equity, and labour market structures in achieving a just transition.

Taken together, these contributions demonstrate that greening TVET is not merely a matter of integrating sustainability competencies into curricula, but a broader transformation involving educational policies, pedagogical practices, institutional capacities, stakeholder collaboration, and labour market structures. While the studies highlight promising approaches to green skills development, they also reveal persistent gaps between policy ambitions and educational implementation, between emerging competency requirements and institutional readiness, and between skills development and sustainable employment opportunities. These tensions underscore that the transition towards greener TVET systems is neither linear nor uniform, but shaped by diverse national, institutional, and socio-economic conditions. Advancing greening TVET therefore requires more than curriculum reform and innovative teaching approaches; it calls for coherent policies, inclusive partnerships, and stronger connections between education, industry, and labour markets. Importantly, the success of green TVET should not be measured solely by the provision of green skills, but also by its contribution to equitable opportunities, decent work, and sustainable livelihoods. We hope that this issue encourages critical reflection on greening TVET—not simply as an educational response to environmental challenges, but as a collective responsibility to shape a more sustainable, inclusive, and socially just future.

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