# Greening TVET: Skills for a Sustainable Africa

Toriola-Coker, O. L *[1], Ayodele-Oja, S[2],

[1]Department of Civil Engineering, Yaba College of Technology, Nigeria

[2]Department of Architecture, Yaba College of Technology, Nigeria

*Corresponding author: toriola.coker@yabatech.edu.ng

## Abstract

As the continent seeks to achieve the African Union's Agenda 2063 and the United Nations Sustainable Development Goals (SDGs), TVET emerges as a crucial driver in creating a workforce with green skills. Africa stands at a key time where sustainable development must become central to its growth trajectory. Technical and Vocational Education and Training (TVET) has the potential to be a key enabler of this transition by providing learners with the green skills required to thrive in a green economy. This article investigates how greening TVET systems might help Africa achieve its environmental goals, with an emphasis on green skills development, the incorporation of sustainable practices into training programs, curricula, renewable energy efforts, and resource management using a literature review as the primary methodology. It emphasizes best practices, analyzes obstacles, and suggests practical initiatives for stakeholders. The evaluation identifies important problems, such as low instructor capacity and outmoded training programs, and makes evidence-based recommendations for aligning TVET with Agenda 2063 and the SDGs. suggesting concrete ways for stakeholders to improve TVET's contribution to Africa's green economic growth and environmental stewardship.

**Keywords:** Africa, Sustainability, TVET

## Introduction

Green technology is the creation and application of goods, machinery, and systems that lower the adverse effects of human activity on the environment and resources (Thirupathy et al., 2020.). Major problems including population increase, rising energy demand and consumption, climate change, pollution, and the rapid depletion of natural resources all demonstrate how unsustainable our society's current practices are. The continent of Africa is rapidly becoming more urbanized and populous, which is putting more strain on the environment and natural resources. Sustainability must be included into every sector as the continent strives to meet the Sustainable Development Goals (SDGs) of the UN and the African Union's Agenda 2063. "Greening TVET" addresses worldwide challenges associated with sustainable development. As UNESCO and the UNESCO-UNEVOC International Center have promoted over the past ten years, it also seeks to assist in the implementation of TVET to improve sustainable development (Thirupathy et al., 2020.) Additionally, it offers the TVET industry greater opportunity to help the global shift to a more sustainable and low-carbon economy. Thus, among the factors moving towards the green paradigm are globalization, resource scarcity, and climate change. TVET must therefore address

the issues by offering green skills that can meet market demands and support long-term societal change (Pandey et al., 2023).

To prepare a workforce that can propel and maintain environmentally responsible economic growth, TVET can be a game-changer (Jasmi et al., 2019.). Initiatives to integrate sustainability into TVET programs face obstacles, including curriculum discrepancies and unequal access to resources among institutions (Chepkoech et al., 2021). The educational industry faces the task of preparing pupils who are truly competitive in the twenty-first century. Communication, creativity, collaboration, and critical thinking are some of the necessary talents that are linked to the four C's of 21st century skilling. In this regard, the Africa's goal is to produce a generation in line with the green technology strategy that is capable of 21st century abilities. Higher education is crucial to bringing about this shift, and scientific and technology education in particular bears a heavy burden because to its transitive role. Technology graduates must help solve the current environmental issues and develop new production methods to meet humanity's requirements now and in the future. These methods must enable the creation and upkeep of a just and sustainable society (Belu et al., 2016). Integrating greening skills into the TVET program is one of the declaration's four out of eight agenda items. This will help achieve sustainable development, which includes reducing poverty and promoting economic growth. We ought to approach our actions toward the environment with a great deal of awareness and comprehension. It also has a significant impact on how people behave toward their surroundings (Thirupathy et al., 2020.).

Historically, development in Africa has been linked to environmental deterioration and a disregard for sustainability. Rapid economic growth is absent from African economies, and the workforce lacks the knowledge and skills necessary for industry (Jahonga et al., 2015). The deficiency of green skills is a primary factor contributing to unemployment among women and youth, as well as exacerbating environmental discord. As the global community prepares to transition to a green economy, Africa is on the verge of being abandoned once more. The hallmark of the TVET training system seems to be the low degree of green technology proficiency among TVET instructors as well as the dearth of green technologies and green skills. Furthermore, Pandey et al., (2023) reviews the idea of incorporating TVET greening into the curriculum. "Greening TVET" or TVET greening requires the creation of a new TVET green curriculum (Thirupathy et al., 2020.). Existing courses and hands-on training in job skills, including new abilities, duties, and competencies, must be included in the curriculum. In essence, greening TVET entails developing new green

competencies through the provision of new green approaches (Belu et al., 2016). The authors in the United States of America presented the results of a US Department of Education-funded initiative on green manufacturing, sustainability, and renewable energy to enhance minority student enrollment and retention in engineering and technology programs (Belu et al., 2016). This is a collaborative initiative between Drexel University and the University of Texas at El Paso. The project aims to expose students to green design, sustainability, renewable energy, and the skills required to integrate sustainable practices into industrial engineering tools. Malaysia's green technology revolution has advanced from a very modest speed to a higher level since the creation of the Ministry of Energy, Green Technology, and Water (KeTTHA). The Ministry promotes green technologies in all areas of development to support the economic transformation towards Vision 2020 (Thirupathy et al., 2020.).

The government has analyzed green technology curriculum for pre-school, primary, and secondary schools. Africa should understand the value of education and training in bolstering efforts to build human capital with advanced technical and professional knowledge and skills in order to increase economic productivity. Additionally, Africa has the capacity to create green technologies and work toward entering the green business, which might boost social and environmental sustainability in addition to the continent's economics. This paper seeks to investigate the transformation of Technical and Vocational Education and Training (TVET) in order to give students, the values, information, and abilities required to aid Africa's shift to a sustainable and green economy. This is effectively achieved by thoroughly examining and synthesizing existing research, strategies, and best practices in green skills development and sustainable vocational training.

## The Research Objectives Includes:

- Evaluate the influence of Technical and Vocational Education and Training (TVET) on environmental sustainability and green economic development in Africa.
- Advocate for the integration of green skills and sustainable practices across TVET courses and institutions.
- Confront obstacles and enhance the significance of TVET in realizing Agenda 2063 and the Sustainable Development Goals (SDGs).

## Methodology

This study uses a literature review method as a systematic way to examine the transformation of Technical and Vocational Education and Training (TVET) to support green economies in Africa. This strategy enables researchers to collect, analyze, and synthesize existing knowledge and evidence from published academic and policy sources to formulate educated conclusions. This statement affirms that prioritizing skills development initiatives should focus on enhancing existing skill sets and strengthening the general competencies of the whole workforce. The level of current and future changes in the green transition depends on technology and market demand. Preparing young people for the labor market requires preparing for new occupations or increasing demand for existing ones. There is increasing apprehension regarding the environmental unsustainability of historical and contemporary economic growth patterns and the potential for irreparably eroding the ecological foundation necessary for economic sustenance. Discussion and findings are addressed to meet the research objectives.

## Discussion of Findings

**Evaluate The Impact of Technical and Vocational Education and Training (TVET) On Environmental Sustainability and Green Economic Development in Africa:** To assess the impact of Technical and Vocational Education and Training (TVET) on environmental sustainability and green economic development in Africa, look at how TVET programs incorporate green skills, promote eco-friendly practices, and align with labor market demands in sustainable sectors like renewable energy, agriculture, and waste management. (RB Mustapha, 2015,). This includes examining curricula, institutional processes, industry collaborations, and graduate outcomes. Furthermore, assessing policy support, funding, and the extent to which TVET helps to achieve national and continental goals such as Agenda 2063 and the SDGs provides a full knowledge of its influence (Jerald et al., 2024a).

**Promote The Integration of Green Skills and Sustainable Practices into TVET Courses and Institutions:** To advocate for the inclusion of green skills and sustainable practices in TVET, stakeholders should support curriculum improvements that incorporate environmental education and climate-responsive skills into all programs. (Sern et al., 2021). This includes training educators in green technology, implementing environmentally friendly infrastructure and campus operations, and collaborating with industry to ensure relevance. Raising awareness, influencing policy, and

showing the economic and environmental benefits of green TVET are all important measures for increasing mainstream adoption and institutional commitment (Maclean et al., 2013).

**Confront Hurdles and Highlight the Importance of TVET In Achieving Agenda 2063 And the Sustainable Development Goals:** In 2024, the African Union Commission (AUC) assessed the approach using a literature analysis, focus group talks, and questionnaire responses from five categories of important stakeholders: ministries, TVET regulators, training providers, employers, and workers' organizations (African Continental TVET Strategy, 2025.).To overcome impediments and strengthen TVET's role in achieving Agenda 2063 and the SDGs, critical difficulties such as limited finance, outdated curricula, and a shortage of skilled professionals must be addressed (Arinzechukwu Okanya et al., 2023). Solutions include boosting funding, upgrading training curriculum to meet green economy objectives, strengthening institutional capacity, and promoting collaboration with industry and government. (Jerald et al., 2024b). Strengthening policy frameworks and encouraging innovation can also help TVET systems better line with sustainable development goals (Muhammad et al., 2024).

**Table 1: Comparison of Reviewed Literature on Greening TVET in Africa**

| **Author(s)& Year** | **Focus Area** | **Methodology** | **Key Findings** | **Recommendations** |
|---|---|---|---|---|
| RB Mustapha (2015,) | Green and sustainable development for TVET in Asia | Qualitative review | Integrates sustainable development with TVET systems globally. | Curriculum reform, policy alignment, and teacher training. |
| Africa's Development Dynamics (2024) | Skills development for Africa's productive transformation | Policy document analysis | TVET plays an important role in long-term growth and young employment. | Align TVET with AU development goals; prioritize green jobs. |

| | | | | |
|---|---|---|---|---|
| (Jerald et al., 2024b) | Greening TVET for Sustainable Skill Development: Opportunities and Challenges in Botswana with a Focus on Quality Education | Case studies & analysis | TVET institutions are incorporating eco-friendly methods and involving companies. | Enhance collaborations, upgrade infrastructure, and update courses. |
| Kelechi Ekuma (2019) | Postcolonialism and national HRD: Understanding contemporary challenges to skills development in sub-Saharan Africa | Empirical data review | Identifies gaps in green skill training and misalignment with labor market demands. | Invest in skill forecasting and workforce alignment. |
| DODE SEIDU (2022) | African perspectives Global insights Policy Briefing 227 | Sectoral studies | Renewable energy and agriculture provide ample prospects for green careers. | Encourage industry-specific training and public-private partnerships. |
| Ulmer & Wydra (2020) | Sustainability in African higher education institutions (HEIs): Shifting the focus from | Literature review | Mainstream TVET institutions have a low adoption rate | Create green TVET regulations, train educators, and integrate SDGs into training. |

| | | | | |
|---|---|---|---|---|
| | researching the gaps to existing activities | | for sustainability. | |

## Recommendation

To integrate Technical and Vocational Education and Training (TVET) with Agenda 2063 and the SDGs, African governments and organizations should:

1. Integrate green skills and sustainability principles into all TVET curriculum to equip students for developing green industries.
2. Invest in instructor training and capacity building to ensure the efficient delivery of environmentally relevant courses.
3. Create national policies and frameworks to prioritize green TVET as part of larger climate and education measures.
4. Promote collaboration among TVET institutions, industry, and environmental organizations to improve relevance, innovation, and job placement.
5. Encourage green infrastructure and sustainable practices on TVET campuses as practical learning tools.
6. Monitor and assess the impact of greening initiatives to ensure ongoing improvement and a measurable contribution to sustainable development.

These actions will allow TVET to play a critical role in accelerating Africa's green transition and realizing the vision of a wealthy, inclusive, and environmentally sustainable future.

## Conclusion

Finally, greening Technical and Vocational Education and Training (TVET) is critical to Africa's sustainable development goals. As the continent faces increasing environmental concerns and attempts to transition to a green economy, TVET programs must change to provide learners with the green skills, knowledge, and values required for sustainable living. This article has underlined TVET's vital role in promoting environmental stewardship through curriculum reform, green skills development, and strong collaborations with industry and policy stakeholders. By connecting TVET with Agenda 2063 and the Sustainable Development Goals (SDGs), Africa can create a trained workforce that promotes innovation in renewable energy, sustainable agriculture, eco-

construction, and resource management. However, accomplishing this objective necessitates overcoming structural barriers such as restricted financing, obsolete curricula, and inadequate instructor training. With targeted reforms, smart investment, and collaborative policymaking, TVET has the potential to become a cornerstone in Africa's green future, empowering youth, safeguarding the environment, and promoting inclusive progress. Greening TVET is more than just an educational reform; it is a transformative strategy for building a resilient, sustainable, and prosperous Africa.

## Reference


African Continental TVET Strategy 2025-34 for Sustainable Development, Social Justice and Employability for all. (n.d.). Retrieved May 19, 2025, from www.au.int

African perspectives Global insights Policy Briefing 227. (2020). https://data.worldbank.org/indicator/NY.GDP.MKTP.

Africa's Development Dynamics 2024. (2024). https://doi.org/10.1787/DF06C7A4-EN

Arinzechukwu Okanya, V., Kuwanta, G. I., & Yohanna, K. P. (2023). Enhancing Integration of Emerging Technologies in Technical Vocational Education andTraining (TVET) Programmes for Sustainable Development. Iterj.OrgV OkanyaINDUSTRIAL TECHNOLOGY EDUCATION RESEARCH JOURNAL, 2023

Belu, R., Chiou, R., … L. C.-J. of E., & 2016, undefined. (2016). Incorporating sustainability and green design concepts into engineering and technology curricula. Edulearn.Intelektual.Org, 10(2), 93–102.

Chepkoech, S., Khatete, I., & Wanjala, G. (2021). Quality of trainers at public technical, vocational, education and training institutions: The missing link in Kenyas skill development. UNIZIK Journal of Educational Research and Policy Studies, 2(1), 1–8. https://doi.org/10.5897/UNIJERPS2021.0001

Jahonga, W. M., Ngore, P. R., & Muramba, V. W. (2015). TRANSFORMING AND GREENING TVET FOR SUSTAINABLE DEVELOPMENT IN WESTERN KENYA. European Journal of Research and Reflection in Management Sciences, 3(2). www.idpublications.org

Jasmi, N., Kamis, A., Research, N. F.-J. of E., & 2019, undefined. (n.d.). Importance of green technology, Education for Sustainable Development (ESD) and environmental education for students and society. Researchgate.NetNF Jasmi, A Kamis, N FarahinJournal of Engineering Research and Application, 2019•researchgate.Net. Retrieved May 14, 2025, from https://www.researchgate.net/profile/Arasinah-Kamis/publication/341477721_Importance_of_Green_Technology_Education_for_Sus

tainable_Development_ESD_and_Environmental_Education_for_Students_and_Society/links/5ec34a9f92851c11a87412fb/Importance-of-Green-Technology-Education-for-Sustainable-Development-ESD-and-Environmental-Education-for-Students-and-Society.pdf

Jerald, H., Tawanda, C., Vijayaratnam, P., & Rajanthran, S. K. (2024a). Greening TVET for Sustainable Skill Development: Opportunities and Challenges in Botswana with a Focus on Quality Education. Journal of Ecohumanism, 3(8), 2979-2985–2979– 2985. https://doi.org/10.62754/JOE.V3I8.4939

Jerald, H., Tawanda, C., Vijayaratnam, P., & Rajanthran, S. K. (2024b). Greening TVET for Sustainable Skill Development: Opportunities and Challenges in Botswana with a Focus on Quality Education. Ecohumanism.Co.UkH Jerald, C Tawanda, P Vijayaratnam, SK RajanthranJournal of Ecohumanism, 2024•ecohumanism.Co.Uk, 3(8), 2979–2985. https://doi.org/10.62754/joe.v3i8.4939

Maclean, R., Jagannathan, S., & Sarvi, J. (2013). Skills development for inclusive and sustainable growth in developing Asia-Pacific. https://library.oapen.org/bitstream/handle/20.500.12657/27967/1002032.pdf?sequence=1

Muhammad, H., Ur Rehman, Z., Manzoor, S. F., & Daud, M. (2024). FOSTERING SUSTAINABILITY IN VOCATIONAL TRAINING INSTITUTES: THE INTERSECTION OF GREEN HUMAN RESOURCE MANAGEMENT (GHRM) AND. Contemporaryjournal.ComRMS Yaqub, HMZ Ur Rehman, SF Manzoor, M DaudContemporary Journal of Social Science Review, 2024•contemporaryjournal.Com, 02(04). https://contemporaryjournal.com/index.php/14/article/view/196

Pandey, M., Минакши, П., Pandey, M. K., & Кумар, П. М. (2023). Green technology & innovation: its implications on the sustainable development in Indian context. Vestnik of Samara University. Economics and Management, 14(1), 87–98. https://doi.org/10.18287/2542-0461-2023-14-1-87-98

Postcolonialism and national HRD: Understanding contemporary challenges to skills development in sub-Saharan Africa. (n.d.). https://doi.org/10.1080/13678868.2019.1612651

R. M.-T. I. J. of T., & 2015, undefined. (n.d.). Green and sustainable development for TVET in Asia. Researchgate.NetRB MustaphaThe International Journal of Technical and Vocational Education, 2015•researchgate.Net. Retrieved May 17, 2025

Sern, L. C., Baharom, N., Foong, L. M., Muda, W. H. N. W., Rosli, D. I., & A., A. (2021). Integrating Green Skills into TVET Curricula in Polytechnics Malaysia. Journal of

Technical Education and Training, 13(3), 15–19. https://doi.org/10.30880/jtet.2021.13.03.002

Thirupathy, S., … R. M. academic research in business and, & 2020, undefined. (n.d.). Development of secondary school students' green skills for sustainable development. Researchgate.NetS Thirupathy, R MustaphaInternational Journal of Academic Research in Business and Social, 2020•researchgate.Net. Retrieved May 14, 2025, from https://www.researchgate.net/profile/Ramlee-Mustapha-3/publication/343672465_Development_of_Secondary_School_Students'_Green_Skills_for_Sustainable_Development/links/60c3f90692851ca6f8dfa3d2/Development-of-Secondary-School-Students-Green-Skills-for-Sustainable-Development.pdf

Ulmer, N., & Wydra, K. (2020). Sustainability in African higher education institutions (HEIs): Shifting the focus from researching the gaps to existing activities. International Journal of Sustainability in Higher Education, 21(1), 18–33. https://doi.org/10.1108/IJSHE-03-2019-0106/FULL/XML