

# Fostering sustainable livelihoods: The role of vocational education and green technology training in youth employment in Tanzania

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## Abstract

Unemployment among young people remains a critical challenge in Tanzania, despite increasing investment in vocational training. Persistent skills mismatches and limited labour-market relevance have constrained the employability of many graduates, particularly in the context of a transitioning green economy. This study examines the combined effects of vocational education and green-technology training on youth employability in Tanzania, guided by Human Capital Theory. The purpose is to assess whether integrating conventional vocational skills with green competencies improves employment outcomes and supports sustainable livelihoods. A quantitative cross-sectional design was employed to survey 171 trainees at the VETA Kipawa ICT Centre using simple random sampling. Data were collected through a structured questionnaire and analysed using descriptive statistics and multiple linear regression in SPSS. Instrument reliability was confirmed with strong Cronbach's alpha values for vocational education ( $\alpha = .958$ ) and green-technology training ( $\alpha = .768$ ). Results show that vocational education positively influences employability ( $\beta = .145$ ,  $p = .048$ ), whereas green technology training is a stronger predictor ( $\beta = .695$ ,  $p = .000$ ), with both accounting for 66.7% of the variance in employment outcomes ( $R^2 = 0.667$ ). The study finds that incorporating green-technology training into TVET programs is necessary to enhance young people's employability and create long-term jobs in Tanzania. It concludes that integrating green technology training into TVET programmes is essential for improving youth employability and fostering sustainable livelihoods. It recommends curriculum reform to embed green skills, strengthen industry partnerships, and expand apprenticeship and green entrepreneurship opportunities, thereby aligning training systems with evolving labour-market demands.

**Keywords:** green technology training; sustainable agenda; vocational education; Tanzania; youth employment

## **Fostering sustainable livelihoods: The role of vocational education and green technology training in youth employment in Tanzania**

### **1. Introduction**

Youth unemployment in low- and middle-income countries is powerfully shaped by persistent mismatches between the skills provided by training systems and those demanded by modern labour markets (Habiyaremye et al., 2022). TVET programmes that integrate labour-market-relevant competencies, especially emerging green-technology skills such as renewable-energy installation and climate-smart agriculture, have been shown to enhance productivity and support transitions to sustainable livelihoods (Faldu, 2025). Although youth unemployment is a global concern, the underlying causes differ by context. In Tanzania, official unemployment rates appear low, yet complementary indicators reveal deeper structural challenges. A sizeable NEET population, widespread informal employment, and limited job stability among TVET graduates demonstrate persistent barriers to meaningful youth employment (ILO, 2024; Mpojota et al., 2025). Weak industry linkages, limited technological exposure, and insufficient integration of green skills further limit the relevance of existing training programmes (NACTVET, 2019; Nnyanzi, 2024).

Across Africa, similar variations exist whereby some countries report extremely high youth unemployment, while others appear to have lower rates that often mask widespread informality and subsistence work (Humaid et al., 2024; Amoa-Gyarteng & Dhliwayo, 2024). Despite the expansion of TVET opportunities, little is known about how green-technology training interacts with vocational education to improve youth employability in Tanzania. Existing studies have not sufficiently examined this combined influence, leaving a gap in understanding how integrated green-skills training can support sustainable youth livelihoods. These differences demonstrate that interventions need to adapt themselves to countries' particular situations, and the success of TVET and green skills interventions is linked with local labour market conditions and institutional capacity. Thus, building on vocational education and green technology training emerges as two key ways for Tanzania to improve youth employability and unlock its demographic dividend for sustainable economic development. VETA Kipawa ICT Centre serves as the study site, as it is among the leading organizations that integrate technical/vocational programmes and emerging green-technology education, thereby making it suitable for examining their combined effect on employability outcomes. Therefore, the purpose of this study is to examine the effects of vocational education and green technology training on youth employability in Tanzania, using Human Capital Theory as the guiding framework. Guided by three main objectives, the study assesses how vocational education influences youth employability, examines the effect of green-technology training on job readiness and employment outcomes, and analyzes the combined contribution of vocational and green skills in promoting sustainable livelihoods, long-term employability, and economic resilience among Tanzanian youth.

**Problem Statement** - Although the policy continues to emphasize skills development through Technical and Vocational Education and Training (TVET), youth unemployment and underemployment in Tanzania remain acute (Kinyondo & Shija, 2024). The skills do not align with the changing needs of the labour market, particularly in green and sustainable industries, thereby limiting the capacity of basic education to produce inclusive jobs (Mpojota et al., 2025). Therefore, higher education graduates are unable to transition into meaningful employment or self-employment, leading to long-term income uncertainty and reliance on informal livelihoods (Moshi et al., 2024). Also, although national development plans such as Tanzania Vision 2025 and the National Skills Development Strategy recognize the role of green technology in facilitating sustainable growth, the lack of integration of green skills into vocational training has been limiting (NACTVET, 2023). Thus, to address the identified gap, this paper empirically investigates whether vocational education combined with green technology training contributes to youth employability in Tanzania. The investigation provides insights into the link between these two types of training and the employment status by examining its implications on

how the combined skills of the youth can enhance the sustainability of their livelihoods

## 2. Literature Review

**Theoretical Review** - Human Capital Theory (HCT), initially formulated by Becker (1964) and based on Adam Smith's previous work, suggests that investment in education, training, and skills accumulation will lead to improvements in a person's productivity and economic capability. Given that vocational education and green-technology training make the most direct contribution to employment by equipping workers with competencies that match labour market demands, these two are strategic investments in employment. HCT is therefore directly relevant to this study, as it connects skill acquisition, technical, practical, and green to improved employment outcomes. Despite its relevance, HCT has been widely critiqued for its assumption of efficient labour markets and its limited acknowledgement of structural constraints such as weak industry linkages, unequal access to training, and mismatches between skills taught and employer needs (Auerbach & Green, 2024; McLean & Kuo, 2024). These criticisms are especially relevant in contexts like Tanzania, where structural barriers often prevent young people from fully benefiting from vocational training. Nevertheless, HCT is relevant because it emphasizes that targeted skill acquisition yields both economic and employability gains, which are particularly important in the era of green technologies for contemporary workforces. The theory offers a logic for more effectively determining whether investment in these forms of training leads to greater skills, employment, and sustainable livelihoods, particularly in a labour market increasingly influenced by technological change and environmental imperatives.

For this study, green technology training refers to structured instructional programmes designed to equip learners with competencies required for work in emerging green and low-carbon sectors. These competencies include solar and other renewable energy installation and maintenance; waste management and recycling technologies; energy-efficiency systems; climate-smart agricultural technologies; and environmental monitoring and sustainable production practices. Such skills are increasingly in demand in green-driven labour markets and are consistent with global trends toward sustainable, resource-efficient economies (ILO, 2019; OECD, 2021; UNESCO-UNEVOC, 2023; Cedefop, 2022). Coupled with vocational competencies, these skills are increasingly essential for advancing sustainable livelihoods. Therefore, HCT provides a strong theoretical foundation for examining how vocational education and green technology training can enhance the employability of Tanzanian youth. Focusing on the economic benefits of skill acquisition, the theory provides a strong basis for assessing whether investments in such training translate into improved employment prospects and contribute to sustainable livelihoods, particularly in an evolving labour market shaped by technological change and environmental imperatives.

**Empirical Review** - Empirical studies on vocational education consistently show that programme effectiveness depends on industry alignment, competency-based delivery, and practical exposure. For example, Mustajab and Irawan (2023) found that labour-market-responsive curricula significantly improve employability, while Li et al. (2025) reported that misaligned TVET programmes in China yielded limited employment outcomes. Similar mixed findings are reported across African contexts: Kenyan and Ghanaian studies highlight improved confidence and employment prospects among TVET graduates but also point to persistent challenges, including outdated equipment, weak employer linkages, and insufficient industrial attachments (Mujuri & Kathomi, 2025; Adza, 2023). These patterns show that vocational training alone does not guarantee employability without support from relevant curricula, industry partnerships, and enabling ecosystems.

Evidence on green-technology skills in African TVET systems is comparatively scarce. These findings collectively reinforce that vocational training alone is insufficient without supportive ecosystems, linkages, financing, and updated curricula. Evidence on green skills in Africa remains limited. Raphael (2021) is among the few to examine green, technical, and soft skills simultaneously, finding that green competencies significantly predict access to decent work. However, he identifies significant gaps in the integration of green technologies into TVET systems. This gap is particularly relevant for Tanzania, where TVET reforms increasingly emphasize

sustainability, but empirical studies rarely examine how green training interacts with vocational education to influence employment outcomes. Most research isolates these skill domains, overlooking how their interaction enhances sustainable employability. Therefore, this study addresses a critical gap by analysing the joint influence of vocational education and green technology training on youth employment outcomes in Tanzania.

**H0<sub>1</sub>:** *There is no significant relationship between vocational education and youths' employability in Tanzania.*

**H1<sub>1</sub>:** *There is a significant relationship between vocational education and youths' employability in Tanzania.*

**H0<sub>2</sub>:** *There is no significant relationship between green technology training and youths' employability in Tanzania.*

**H1<sub>2</sub>:** *There is a significant relationship between green technology training and youths' employability in Tanzania.*

The conceptual framework demonstrates an additive relationship, whereby vocational education and green-technology training each work independently to improve youth employability in Tanzania. In alignment with Human Capital Theory, the model also assumes that investment in job-relevant skills increases individuals' productivity, competitiveness, and labour market readiness. Vocational education develops technical, practical, and industry-aligned competencies, whereas green-technology training equips learners with skills relevant to emerging green sectors such as renewable energy and climate-smart agriculture. Both improve youth employability in the workplace by enhancing their job readiness, adaptability, and access to sustainable livelihood opportunities.

### 3. Methodology

**Research Approach** - The study employs a quantitative research approach. The methodology allows the researcher to apply systematic statistical methods to derive objective findings. The approach is scientifically appropriate because it helps test the hypothesis, identify statistically significant patterns, and thus establish empirical evidence.

**Research Design** - This study adopts an explanatory research design to identify and analyse causal relationships among variables, specifically the influence of vocational education and green technology training on youth employment. This design is scientifically appropriate because it allows the researcher to test hypotheses and determine both the strength and direction of these relationships. Importantly, the explanatory design is operationalised through regression analysis, which quantitatively examines how the independent variables (vocational education and green-technology training) predict the dependent variables (youth employment and livelihood sustainability). This approach provides robust empirical evidence to inform TVET policy, curriculum development, and green-skills integration initiatives.

**Population of the Study** - The population for this study comprised 300 Tanzanian youth aged 18-35 years who had completed technical and vocational education and training (TVET) or short-course green technology programmes at the VETA Kipawa ICT Centre in Ilala District, Dar es Salaam, within the past five years. This population is appropriate because it comprises young people who have recently acquired vocational and green-related skills and are therefore well positioned to report on their employment experiences, skill utilisation, and livelihood outcomes. The choice of VETA Kipawa is well informed by the fact that it is one of Tanzania's public training centres and offers courses aligned with national skills-development priorities, such as ICT and emerging green-technology areas. Targeting graduates from a single, well-regulated institution provides a more precisely defined sampling frame, which minimizes differences in training quality across providers that contribute to noise among trainees and improves our ability to measure how vocational and green skills training affects youth employment in Tanzania.

**Sample Size and Sampling Techniques** - The sample size was determined using the formula below, adapted from Slovin (1960). Therefore, the study included 171 youths who had completed technical and vocational

education and training (TVET) or short-course green-technology programs at the VETA Kipawa ICT Centre in Ilala District. The study employed simple random sampling, which was feasible because the VETA Kipawa ICT Centre provided a complete and up-to-date register of graduates with their contact details, ensuring an equal chance of selection for all individuals. This method is scientifically justified because it minimizes selection bias, enhances the reliability of the findings, and supports generalization to the broader population of youth trained at the center. Random sampling is particularly suitable in this context because the population is homogeneous with respect to exposure to vocational and green-technology training, thereby enabling fair and unbiased estimation of how such training influences employment outcomes and livelihood prospects.

**Data Collection Instruments** - The research employed a closed-ended questionnaire to collect data. The questions were structured to avoid requiring respondents to write their own answers; instead, they used predefined response options, namely a 5-point Likert scale with responses ranging from Strongly Disagree to Strongly Agree. The survey was distributed via Google Forms to the contacted respondents. This format simplified data collection by providing respondents with distinct, specific answer options that were easier to respond to, thereby improving the efficiency of data analysis. The closed-ended questions and standardized response scale ensured consistent responses across participants and facilitated quantitative analysis. To enhance the instrument's quality, the questionnaire was first reviewed by subject-matter experts to assess its relevance, clarity, and alignment with the study objectives. Following expert validation, the tool was piloted with 20 respondents who shared characteristics similar to those of the target population. Feedback from the pilot exercise informed minor adjustments to wording and sequencing to improve comprehension and reliability before the full deployment of the questionnaire.

**Measurement of the Variables** - To ensure clarity and consistency in data collection, this study used specific indicators to measure both the independent and dependent variables. Each variable was operationalized through observable items that capture its key aspects. The variable measurements and their indicators are summarized in Table 1 below.

**Table 1**  
*Measurement of the Variables*

Variable	Measurements Measurement Scale	Source
<b>Independent Variables</b>		
Vocational Education (VE)	VE1: Training quality VE2: Curriculum relevance VE3: Practical exposure VE4: Industry linkages VE5: Skill competence	5-point Likert scale Mustajab and Irawan (2023);
Green Technology Training (GT)	GT1: Job readiness GT2: Skill application scale GT3: Employment opportunities GT4: Income improvement GT5: Work confidence	5-point Likert scale Li et al. (2025)
<b>Dependent Variable</b>		
Youth Employability (YE)	YE1: Employment status YE2: Employment stability YE3: Job search duration YE4: Income reliability YE5: Employment retention	5-point Likert scale Adza (2023); Raphael (2021)

**Data Analysis** - To analyze the quantitative data, the study employed descriptive statistics and linear regression using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics provided an overview of the key variables and helped identify patterns and trends in the data. Subsequently, linear regression was used to assess the magnitude and direction of the association between the independent and outcome variables.

**Validity and Reliability** - To evaluate the appropriateness of the data for the analysis, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were used to assess the validity of the research instrument. Table 2 shows that the KMO value was 0.895, exceeding the recommended value of 0.6, indicating that the sample size was sufficient and that factor analysis was warranted. Moreover, Bartlett's test of sphericity was significant (Approx. Chi-Square = 1945.517, df = 91,  $p < 0.001$ ), indicating that the overall correlations among items were significant enough to warrant analysis. These findings confirm the instrument's high construct validity, indicating that the questionnaire items effectively measure the intended variables.

**Table 2**  
*KMO and Bartlett's Test Results (n = 171)*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.895
Bartlett's Test of Sphericity Approx. Chi-Square	1945.517
df	91
Sig.	.000

Source: Field Data, 2025

The reliability test results indicate that the measurement scales used in the study were dependable and internally consistent. Vocational education showed an excellent Cronbach's alpha of 0.945, indicating very strong internal consistency across all five items. Green technology training and youth employment both showed acceptable reliability (0.723 and 0.704, respectively), suggesting that the items in these scales were sufficiently correlated to measure their intended constructs with confidence. These results imply that the questionnaire items were well-designed and that the collected data are reliable for further statistical analysis, including regression testing, without concerns about measurement error.

**Table 3**  
*Reliability test results (n = 171)*

Variable	No. of Items	Cronbach's Alpha	Remarks
1. Vocational Education	5	.945	Excellent
2. Green Technology Training	5	.723	Reliable
3. Youth Employment	5	.704	Reliable

Source: Field Data, 2025

**Ethical Considerations** - This study involved human participants and received ethical approval from the VETA Kipawa ICT Centre Research Committee (Approval No. VKC/RE/2025/014) in accordance with institutional guidelines. Participation was voluntary, and respondents were informed of the study's purpose, procedures, and benefits, as well as their right to withdraw without penalty, before providing written consent. Confidentiality and anonymity were ensured by collecting no personal identifiers, coding questionnaires, and securely storing data in password-protected files and locked cabinets accessible only to the researcher. The study posed minimal ethical risk, with no physical, psychological, or social harm beyond routine survey participation, in accordance with accepted research ethics.

**Data Cleaning** - Missing or irregular responses were screened and eliminated. The observations were inspected for outliers and normality, and the data were deemed to meet the appropriate analytical criteria. Such processes enhanced the credibility, reliability, and integrity of this study's results.

#### 4. Findings

**Descriptive Statistics** - The section presents descriptive statistics for the study variables, summarizing central tendencies and the variability in respondents' perceptions. The descriptive analysis summarizes how participants rated various aspects of vocational education and green technology training, along with their experiences with youth employability, to identify general trends before proceeding to further inferential analysis.

**Table 4**  
*Descriptive Statistics Results on Vocational Education (n = 171)*

	Mean	Std. Dev
The training provided at VETA was of high quality.	3.65	1.150
The curriculum matched the skills required in the current labour market.	3.66	1.064
I had sufficient opportunities for hands-on practical training	3.68	1.033
I had opportunities for internships and field-learning attachments	3.79	1.069
The training equipped me with the technical skills needed for employment	3.60	1.124

Source: Field Data, 2025

The descriptive results indicate that respondents generally agreed that the vocational training they received at VETA was of satisfactory quality, with mean scores ranging from 3.60 to 3.79. The highest rating was for opportunities for internships and field attachments ( $M = 3.79$ ,  $SD = 1.069$ ), suggesting that practical exposure was a notable strength of the program. Curriculum relevance ( $M = 3.66$ ) and training quality ( $M = 3.65$ ) also received positive assessments, although moderate standard deviations indicate some variation in graduates' experiences. These findings align with Human Capital Theory, which posits that skill acquisition and practical exposure enhance productivity and employment potential. They imply that vocational education at VETA provides a reasonably strong foundation for employability, particularly through hands-on training and industry exposure, aligning with the study's objective of assessing how vocational education contributes to youth employment outcomes in Tanzania.

**Table 5**  
*Descriptive Statistics Results on Green Technology Training (n = 171)*

	Mean	Std. Dev
The training has prepared me for available jobs in the field.	3.72	1.123
I can apply the skills I've learned in real-world situations.	3.57	1.106
The training has increased my chances of finding employment.	3.57	1.143
The training has helped me earn a better income.	4.02	1.037
I feel confident performing tasks related to my training.	4.16	.938

Source: Field Data, 2025

The results show that respondents held generally positive views about the green technology training they received, with mean scores ranging from 3.57 to 4.16. Confidence in performing training-related tasks recorded the highest mean (4.16), followed by improved income (4.02), suggesting that the programme strengthened both competence and livelihood outcomes. Job readiness (3.72) and skill application (3.57) were also rated favourably, although the relatively high standard deviations indicate some variation in the extent to which graduates benefited from the training. These findings imply that green technology training meaningfully enhances youth employability and income prospects, thereby directly supporting the study's objective of examining how green technology skills influence employment outcomes in Tanzania.

**Table 6**  
*Descriptive Statistics Results on Youths' Employability (n = 171)*

	Mean	Std. Dev
My current employment status is directly attributable to the training I received at VETA.	3.57	1.143
My current work arrangement provides stable and regular employment.	4.16	.938
The training I received helped me reduce the time taken to find employment.	3.55	1.075
My current job or business provides a reliable income.	3.82	.838
I can keep my job without major difficulties.	3.99	.815

Source: Field Data, 2025

The findings indicate generally positive perceptions of employability among respondents, with mean scores ranging from 3.55 to 4.16. Employment stability received the highest rating ( $M = 4.16$ ), suggesting that many graduates felt securely placed in their current work arrangements. Job retention ( $M = 3.99$ ) and income reliability ( $M = 3.82$ ) were also rated favourably, reflecting improved livelihood conditions after training. Although the link between training and employment status ( $M = 3.57$ ) and reduced job-search duration ( $M = 3.55$ ) was slightly

lower, the results still suggest a meaningful contribution of vocational and green-technology training to graduates' ability to secure and maintain employment. These outcomes reinforce the study's objective of assessing how such training enhances youth employability, indicating that both skill acquisition and practical exposure support more stable and sustainable employment pathways in Tanzania.

**Table 7**  
*Correlation Matrix*

Variable	1	2	3
Vocational Education	1		
Green Technology Training	.42	1	
Youth Employability	.41	.68	1

Note:  $p < 0.01$ ;  $n = 171$

The correlation matrix shows significant positive relationships between both independent variables and youth employability, with green technology training showing a stronger association ( $r = .68$ ) than vocational education ( $r = .41$ ), supporting the relevance of greenskills interventions for sustainable employment outcomes.

**Hypothesis Testing Results** - This section presents the hypothesis-testing results from the multiple regression analysis examining the influence of vocational education and green technology training on youth employability. Diagnostic checks confirm that the regression assumptions, including multicollinearity, linearity, and model fit, are met before interpreting the results. Next, collinearity diagnostics, model summary, ANOVA results, and coefficient estimates are tabulated to assess the effect size, direction, and strength of the relationships between the independent variables and youth employability in the study area.

**Table 8**  
*Collinearity Diagnostics*

Model	Dimension	Eigenvalue	Condition	Variance	Proportions		
1	1	2.957	1.000	.00	.00	.00	
	2	.034	9.264	.59	.28	.00	
3	.008 19.034			.41	.72	.99	

a. Dependent Variable: Youth Employability

Source: Field Data, 2025

The collinearity diagnostics indicate that the regression model is not affected by harmful multicollinearity. The condition indices, with the highest value at 19.034, remain below the commonly accepted threshold of 30, suggesting that the predictor variables are not excessively correlated. Although some variance proportions for vocational education and green technology training load moderately on the same dimension, the values do not indicate a level that would distort coefficient estimates or undermine the model's stability. These results imply that vocational education and green technology training can be analyzed jointly within the same regression model without concern for inflated standard errors, thereby supporting the validity of subsequent hypothesis testing.

**Table 9**  
*Model Summary*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.816 <sup>a</sup>	.667	.663	.38124

a. Predictors: (Constant), Green Technology Training, Vocational Education

**Table 10**  
*Coefficients*

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	48.802	2	24.401	167.884	.000 <sup>b</sup>
1 Residual	24.418		.145		
Total	73.220	170			

Dependent Variable: Youth Employability

Predictors: (Constant), Green Technology Training, Vocational Education

**Table 11**  
*Coefficients*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.111	.155		7.157	.000
1 Vocational Education	.096	.050	.145	1.910	.048
Green Technology Training	.618	.067	.695	9.179	.000

a. Dependent Variable: Youth Employability

Source: Field Data, 2025

The regression results show that vocational education has a positive and statistically significant effect on youth employability ( $\beta = .145$ ,  $p = .048$ ), indicating that improvements in training quality, curriculum relevance, and practical exposure meaningfully contribute to better employment outcomes. Although the effect size is small, the coefficient's significance indicates that vocational education remains an important predictor in the model. The implication is that strengthening vocational training can enhance youth employment prospects and retention, thereby supporting the first research hypothesis and reinforcing the role of TVET reforms in addressing skills gaps in Tanzania. Green technology training has a strong, highly significant effect on youth employability ( $\beta = .695$ ,  $p = .000$ ), making it the dominant predictor in the model. This result suggests that green-technology skills substantially enhance job readiness, income stability, and work confidence among young people. Together, vocational education and green technology training explain 66.7% of the variation in youth employability, underscoring the meaningful contribution of green skills and confirming the growing demand for environmentally aligned competencies in emerging labor markets. The implication is that integrating green technology modules into mainstream TVET programs can considerably improve employment prospects, thereby supporting the second hypothesis and providing clear evidence for policy adoption to support sustainable livelihood pathways for Tanzanian youth.

## 5. Discussion of the Findings

The findings align with Human Capital Theory, confirming that investment in vocational education and green-technology training enhances skills, productivity, and youth employability. Vocational education shows a modest but significant effect, reinforcing evidence that investment in human capital can reduce unemployment and support sustainable livelihoods, consistent with the contextual realities of Tanzania's labor market. Although the effect size is smaller than that reported by Mustajab and Irawan (2023), who observed a stronger link between vocational training and employment outcomes in other settings, the significance of vocational education in this study suggests that even incremental improvements in training quality, curriculum relevance, and practical exposure can matter in labor markets where formal job creation remains limited.

The overall negligible effect may reflect structural constraints peculiar to Tanzania, including unequal industrial linkages, the predominance of informal employment, and limited formal apprenticeships. These constraints help explain why Li et al. (2025) found weak employment effects in settings with insufficient program design and labor-market alignment, underscoring the need for Tanzania to continue strengthening the coherence between training institutions and industry needs if vocational education is to deliver more substantial labor-market returns. Green technology training had a significantly stronger influence on youth employability, accounting for 41.5% of the variance, a finding consistent with Raphael's (2021) observation that green-skilled graduates enjoy clearer pathways into emerging labor-market opportunities. In this regard, the study's findings suggest that green technology competencies are increasingly valued as Tanzania expands its sustainability agenda and aligns with the global transition to green growth.

This result also aligns with trends reported by Mujuri and Kathomi (2025), who found that employment prospects improve significantly when training aligns with contemporary sectoral demands, even amid persistent structural challenges. Green-technology training strongly influences youth employability in Tanzania, reflecting labor-market adaptation to environmental policies, renewable energy investments, and climate-resilient skill

demands. National initiatives such as Vision 2025 and green-growth projects have created high-demand opportunities, making green-technology training the dominant predictor of employment and crucial for supporting sustainable livelihoods. The high coefficient also indicates that green-technology training provides clearer job pathways through installation, maintenance, microenterprise, and service provision, particularly in the semi-formal and informal green sectors, which are expanding faster than traditional industries.

## 6. Conclusion and Recommendations

**Conclusion** - This study examined how vocational education and green-technology training influence youth employability in Tanzania. The findings show that both forms of training significantly improve employment outcomes; however, green-technology training is more likely to do so than vocational training. Vocational education is important for developing practical skills and industry-relevant competencies. In contrast, green-technology training contributes only to job readiness for future roles in sectors such as renewable energy, waste management, and climate-smart agriculture. Collectively, this study highlights the critical importance of integrating green skills into TVET programs to tailor training to labor-market transitions and support the sustainable livelihoods these programs aim to achieve. Consequently, there is a need to strengthen these two skill domains to enhance youth employability in a labor market that continues to transform, particularly amid environmental and technological challenges. Longitudinal or comparative studies across different TVET centers are warranted to develop an understanding of long-term employability trajectories and the real-world applications of green skills.

**Recommendations** - Based on the study findings, TVET authorities should integrate essential green competencies, such as renewable energy systems, waste management technologies, and climate-smart agriculture, into national training standards to better align skills development with labor market transitions. Strengthening collaboration between TVET institutions and industry is equally important to enhance curriculum relevance, improve access to modern training equipment, and establish formalized apprenticeship pathways that connect trainees to green employment opportunities. Additionally, institutional capacity should be further developed through the upskilling of instructors, strengthening training infrastructure, and greater encouragement of youth to learn about and engage in green entrepreneurship and self-employment. Collectively, this study highlights the unique advantage of combining vocational skills education with green-technology training to enhance youth employability; therefore, an integrated skills approach is crucial for developing sustainable livelihoods in Tanzania.

**Limitations and Future Research** - This study provides substantial empirical evidence on the impact of vocational education and green technology training on youth employability and sustainable livelihoods in Tanzania. However, it has several limitations that warrant careful consideration. First, the cross-sectional design limits causal inference and fails to capture the dynamic nature of labor market transitions or the long-term sustainability of employment outcomes. Future research should employ longitudinal methods to analyze how vocational and green skills affect employment stability, income growth, and livelihood sustainability over time. In addition, the study was conducted at a single TVET institution, which may limit the generalizability of the findings across Tanzania, given disparities in institutional capacity, program quality, and regional labor market conditions. Future research extending to TVET institutions across diverse geographic and socioeconomic contexts would enhance external validity and provide a more comprehensive understanding of national youth employability dynamics. Moreover, self-reported indicators were used to assess employability outcomes. These indicators may be biased by respondents' perceptions and social desirability. Future research should incorporate objective employment metrics, such as job placement statistics, income levels, and employer evaluations, to improve measurement reliability and analytical precision.

Last but not least, although the study is grounded in Human Capital Theory, it does not account for other structural and contextual factors that influence youth employment outcomes. Future research should broaden the analytical framework to include digital competencies, entrepreneurial support systems, industry collaborations,

and the effectiveness of policy implementation, thereby enhancing both theoretical coherence and policy significance. Addressing these constraints will enable a more sophisticated and scalable understanding of how vocational education and green-technology training can collaborate to promote sustainable youth employment and advance long-term livelihoods in emerging economies.

**Declaration of AI use** - While preparing this work, the authors used Grammarly and online AI-assisted technologies to check grammar and spelling. After using the tools, the authors reviewed and edited the content as required and assumed full responsibility for the publication.

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