

# Enhanced multinomial logistic regression analysis of determinants influencing technical and vocational education and training (TVET) choices among Ghanaian youth: Implications for policy development

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**Abstract:** In Ghana, youth unemployment remains significant challenges, with technical and vocational education and training (TVET) emerging as a potential solution to equip young people with practical skills for the job market. However, the uptake of TVET programmes among Ghanaian youth remains low, particularly among females. This study therefore explores the determinants that influence TVET choices among Ghanaian youth, with the goal of informing policy development to enhance participation in vocational education. Applying an enhanced multinomial logistic regression (MLR) model, this research examines the influence of socio-economic, demographic, and attitudinal factors on career decisions. The enhanced model accounts for class imbalances in the dataset and improves classification accuracy, making it a robust tool for understanding the drivers behind TVET choices. A sample of 1600 Ghanaian youth engaged in vocational careers was used, ensuring diverse representation of the population. Key findings reveal that males are approximately three times more likely to choose TVET programs than females, despite females making up 50.13% of Ghana's population. Specific determinants influencing TVET choices include financial constraints, parental influence, peer influence, teacher influence, self-motivation, and vocational limitations. In regions with limited vocational options, youth often pursue careers based on availability rather than preference, which highlights a gap in vocational opportunities. Parental and teacher influences were found to play a dominant role in steering youth towards specific careers. The study concludes with recommendations for policymakers, instructors, and stakeholders to increase the accessibility, relevance, and quality of TVET programmes to meet the socio-economic needs of Ghanaian youth.

**Keywords:** limited vocations; Ghanaian youth; determinants of TVET choices; policy implications; multinomial logistic regression (MLR)

## 1. Introduction

Technical and vocational education and training (TVET) plays a critical role in facilitating economic growth and reducing unemployment, especially in developing countries like Ghana (Buba et al., 2022). Studies have demonstrated that TVET programmes can improve employment opportunities, increase income levels, and reduce poverty rates. For example, a study by Agyemang and Amoako (2023) found that TVET graduates in Ghana had higher employment rates and earned significantly more than non-TVET graduates. Additionally, a study by Pongo et al. (2014) highlighted the importance of TVET in promoting self-employment among the youth. that TVET programmes, specifically those offered by Integrated Community Centre

for Employable Skills (ICCES), have a significant positive impact on the socio-economic development of Ghana. They concluded that trainees in the ICCES programmes were able to secure suitable employment that helped them to gain income in their communities, leading to improved economic and social status.

Also, by equipping individuals with practical skills, TVET helps bridge the gap between education and the labour market, making it an essential tool for socioeconomic development. However, despite its significance, there remains a persistent mismatch between the skills acquired through TVET programmes and the demands of the labour market in Ghana (Norain Jaafar et al., 2018). If unaddressed, this gap could exacerbate youth unemployment, deepen economic inequality, and undermine long-term economic growth.

Understanding the factors influencing individuals' decisions to pursue TVET is crucial for developing policies that can better align vocational education with market needs. Previous studies have highlighted the challenges of gender disparities and inadequate career guidance in the TVET sector (Najoli, 2019; Zelloth, 2014). For instance, Najoli (2019) noted that female participation remains particularly low in TVET and Science, Technology, Engineering and Mathematics (STEM) fields, largely due to societal expectations and gender biases. Furthermore, Zelloth (2014) pointed out that the lack of comprehensive career guidance often leaves youth with limited awareness of vocational opportunities, further contributing to the imbalance in TVET participation.

In developing economies, the informal sector constitutes a significant portion of the workforce. This sector, comprising agriculture, small-scale trade, and local enterprises, provides livelihoods for a large segment of the population, particularly in rural areas (Korang, 2021; Melak and Derbe, 2022). Yet, influential factors determining vocational choices within this informal sector remain under-researched. The informal nature of these activities introduces complexities in both data collection and analysis, making it difficult to accurately model vocational choices using traditional statistical approaches (Chen, 2006; Mugoda et al., 2020).

Several studies have attempted to identify key determinants of TVET participation. For instance, Boeren (2016) demonstrated a positive correlation between higher levels of education and the likelihood of pursuing TVET. However, the type of education, whether vocational or general, plays an important role (Deissinger, 2019). Socioeconomic factors, such as family income and parental occupation, have also been shown to influence vocational decisions. Individuals from lower socioeconomic backgrounds are more likely to pursue TVET as a pathway to financial stability, while those from wealthier families often have alternative educational and career options (Haseloff et al., 2017).

Geographical accessibility further complicates vocational decisions. King (2019, 2020) emphasized that the availability of training facilities and proximity to vocational schools significantly affect students' TVET choices. Moreover, perceptions of future employment opportunities in various vocational fields also play a vital role (Kisielewska, 2014). The ILO (2019) study reports some important challenges of the informal sector. That the informal sector in developing countries faces significant challenges such as limited access to resources, job insecurity, and poor working conditions. Despite these issues, the sector has considerable potential for economic

growth and job creation. The study recommends strategies to support the informal sector, including improving access to finance, offering business development training, and encouraging the formalization of informal businesses. Hence, without proper research and policy intervention, these factors could widen the skill gap, leaving youth underprepared for available job opportunities.

Given the heterogeneity of the informal sector and the limitations of traditional models, this study employs an enhanced Multinomial Logistic Regression (MLR) model to explore the determinants of TVET choices. Traditional logistic regression models, while effective in many contexts, may not fully capture the complexities of vocational decisions within the informal sector, where standard sampling methods often fail to represent the diverse and fluid nature of informal work (Shen et al., 2015; Vanek, 2014). The enhanced MLR model utilized in this study incorporates survey weights to account for sample biases, addressing the sector's unique characteristics and offering a more accurate depiction of TVET choices (Abdul Hamid et al., 2018; Ghosh, 2013).

Accurately modelling vocational choices is essential for developing targeted interventions that align with labour market needs. A mismatch between vocational training and market demands can lead to underemployment or even unemployment, especially in the informal sector where opportunities are often limited (Oluwatoyin Adewale, 2017). However, selecting the right vocational programme can significantly improve employability and job satisfaction, contributing to both individual well-being and national economic development.

Thus, this study aims to address the gap in research by applying an enhanced MLR model to identify the key determinants influencing TVET choices among Ghanaian youth. Specifically, the research will:

- 1) Develop an improved MLR model that accurately predicts the determinants of vocational choices in the informal sector, considering the sample design.
- 2) Identify critical factors influencing vocational decisions among Ghanaian youth, particularly in the informal economy.
- 3) Provide policymakers with data-driven insights to design more effective TVET interventions that promote participation and align with labour market demands.

By incorporating these methodologies, this study adds to the existing body of literature and provides actionable insights for policymakers and stakeholders. Addressing the challenges of gender disparities, socioeconomic barriers, and accessibility can help bridge the gap between vocational education and employment outcomes, ultimately fostering economic resilience and reducing inequality in Ghana (Chelimo, 2022; Owusu-Agyeman and Aryeh-Adjei, 2023).

## **2. Materials and methods**

The methods involve taking a representative sample using multistage sampling technique. This technique was chosen to reflect the diversity of vocations across different regions and demographic groups. Alvi (2016) highlighted the effectiveness of the multistage sampling technique in improving sample representativeness. This method according to Alvi (2016) recognizes the diversity within the informal TVET population by first categorizing it into vocational groups such as building construction,

mechanics, sewing, beauticians, hospitality, driving, masonry, and electrical and electronics. Sixteen regions were stratified, with four randomly selected: Ashanti, Central, Greater Accra, and Brong Ahafo. The use of random sampling helped ensure that everyone in the population had an equal chance of being selected.

Each region was further divided into distinct TVET programmes. Using Yamane's formula:

$$\text{(sample size } n \geq \frac{N}{1+N(0.05)^2}, N = \text{size of TVET population in a region),}$$

a sample size of approximately 400 individuals was determined for each region, resulting in a total sample of 1600 participants.

While slight variations in sample sizes occurred due to the availability of trainees, the overall sample remained representative. However, the unstructured nature of the informal sector posed challenges in data collection. Despite these challenges, the following data were obtained through questionnaire and interview: Mechanical (250), Electrical and Electronics (150), Hospitality (260), Building and Construction (170), Sewing (240), Beauticians (180), and Commercial Driving (200).

Analysing the data, descriptive statistics was first used to assess the vocational and educational backgrounds of the respondents, disaggregated by gender. This step helps identify potential gender disparities in TVET choices. Next, a correlation matrix was employed to evaluate the relationships between the independent variables (in this study, we used a threshold of absolute correlation coefficient  $|r| \leq 0.3$ ) to ensure that the independent variables are not moderately correlated and thereby eliminate suspicion of multicollinearity. This was supported by the standard error of estimates. A small standard error means the estimates are precise. These combined approaches also check multicollinearity which has a potential of turning out unreliable coefficient estimates and thereby making it difficult to draw accurate and reliable conclusions from data. To deal with variables that show strong relationships, we may delete or combine such variables, using Principal Component Analysis (PCA).

The study then employs a modified Multinomial Logistic Regression (MLR) model, specifically a survey-weighted logit model, designed to capture the complexities of TVET choices more accurately. This approach incorporates additional parameters to account for various challenges often encountered in data collection, including non-response and sampling imbalances (Agresti, 2019). The model was applied to a dataset consisting of TVET choices from a sample of one thousand six hundred (1600) individuals actively engaged in vocational careers.

Noting that some key assumptions of the MLR model, if not checked, could affect the results, the independence of observations and no perfect multicollinearity were examined as mentioned earlier. To address the assumption of the independence of irrelevant alternatives (IIA) in the model, two procedures were implemented. First, the trainee selected only one of the dependent variables, ensuring no violation of the IIA assumption. Second, sampling weights were utilized to mitigate the limitations of the IIA assumption in multinomial logistic regression models. According to Greene (2012), these weights adjust the relative importance of different alternatives in the choice set. By assigning different weights to various alternatives, sampling weights can account for factors that violate the IIA assumption, such as population

heterogeneity, correlated alternatives, and the omission of important variables from the model. The analysis was conducted using R statistical software (Li et al., 2020; Liu et al., 2023).

Addressing non-response bias is a critical concern in survey research, as it can skew results if certain groups are less likely to participate. To minimize this issue, the study implemented several strategies. First, the data collection process included multiple follow-up contacts with participants who did not initially respond, using in-person visits where necessary. Small incentives were offered to participants who initially were reluctant to participate on the basis that they would not benefit financially from this research. This process encouraged participation and improved response rate, thereby reducing non-response bias. Next, as mentioned earlier, survey weights were applied to the MLR model to adjust for non-response and ensure that the results were representative of the overall population. These weights were calculated based on demographic data, allowing the model to compensate for any underrepresented groups.

Addressing group imbalance where some vocations may have fewer respondents than others, the sampling weights were determined for each stratum to ensure that each vocational category was adequately represented in the dataset. Where necessary, poststratification adjustments could be made thereby correcting for any imbalances not fully taken care of by the sampling weights. Lastly, the study estimated the standard errors of the models, ensuring that the results were robust across various subsets of the data.

## 2.1. Survey-weighted multinomial logistic regression

Employing the survey-weighted MLR model improves the overall performance of the model by predicting TVET career choices as the outcome variable, accounting for the probability of selection, and addressing biases in the data collection, such as under or oversampling. Understanding the influence of each variable on TVET career choice requires interpreting the model coefficients. Hence, understanding the logistic function is crucial.

Given the multiple linear regression

$$Y_j = \beta_{0j} + \beta_{1j}X_1 + \dots + \beta_{ij}X_i + \varepsilon_{ij} \text{ for } i = 1, 2, \dots, k; j = 1, 2, \dots, J \quad (1)$$

where;

$$Y_j = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_j \\ \vdots \\ Y_J \end{bmatrix}, X_i = \begin{bmatrix} 1 & x_{11} & x_{12} & \dots & x_{1k} \\ 1 & x_{21} & x_{22} & \dots & x_{2k} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ \vdots & \vdots & \vdots & \dots & \vdots \\ 1 & x_{n1} & x_{n2} & \dots & x_{nk} \end{bmatrix}, \beta_j = \begin{bmatrix} \beta_{0j} \\ \beta_{1j} \\ \vdots \\ \beta_{kj} \end{bmatrix}, \varepsilon_{ij} = \begin{bmatrix} \varepsilon_{1j} \\ \varepsilon_{2j} \\ \vdots \\ \varepsilon_{kj} \end{bmatrix}$$

Implies  $Y_j = \beta_{0j} + \beta_{ij}X_i$  where  $\varepsilon_{ij} = 0$

The logistic function (the logit) is an expression of the log of odds equal to the linear regression (Bisht and Pattanaik, 2021; Kuha and Mills, 2020; Ragazou et al., 2022; Sifringer et al., 2020) as;

$$\ln\left(\frac{p(x)}{1-p(x)}\right) = Y_j$$

Transformed as;

$$p(x) = \frac{e^{Y_j}}{1+e^{Y_j}} \quad (2)$$

Hence, the likelihood that  $Y$  takes a value of 1 or 0 is

$$P(Y_j = 1/x) = p(x) = \frac{e^{\beta_{0j} + \beta_{1j}X_1 + \dots + \beta_{kj}X_k}}{1 + e^{\beta_{0j} + \beta_{1j}X_1 + \dots + \beta_{kj}X_k}} = \frac{e^{\beta_{0j} + \beta_{ij}X_i}}{1 + e^{\beta_{0j} + \beta_{ij}X_i}} \quad (3)$$

To fit the multinomial logit,  $Y$  (TVET choices) is set as a categorically unordered limited dependent variable and each observation of this outcome variable follows the Bernoulli distribution (Cirillo and Ramos, 2014; Li and Fan, 2019; Paul et al., 2018). From (Archer and Lemeshow, 2006; Greene, 2012; Ragazou et al., 2022).

$$P(Y) = p^{y_j}(1-p)^{(1-y_j)} \quad (4)$$

$$l = \prod_{i=1}^k p^{y_j} (1-p)^{(1-y_j)}$$

$$\text{But for } P(Y = 1) = P = \frac{e^{(\beta_{0j} + X_i \beta_{ij})}}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \quad \begin{cases} i = 1, 2, \dots, k \\ j = 1, 2, \dots, J \end{cases}$$

$$l = \prod_{i=1}^k \left[ \frac{e^{(\beta_{0j} + X_i \beta_{ij})}}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right]^{y_i} \left[ \frac{1}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right]^{(1-y_i)} \quad (5)$$

$$l = \left[ \frac{e^{(\beta_{0j} + X_i \beta_{ij})}}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right]^{\sum_{i=1}^k y_i} \left[ \frac{1}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right]^{\sum_{i=1}^k (1-y_i)}$$

$$\ln(L) = \sum_{i=1}^k y_i \left( \frac{e^{(\beta_{0j} + X_i \beta_{ij})}}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right) + \sum_{i=1}^k (1 - y_i) \left( \frac{1}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \right) \quad (6)$$

Hence, the maximum likelihood function is

$$\frac{\partial \ln(L)}{\partial \beta} = \left( \sum_{i=1}^k X_i y_i \right) - \frac{\sum_{i=1}^k (\beta_{0j} + X_i \beta_{ij})}{1 + e^{(\beta_{0j} + X_i \beta_{ij})}} \quad (7)$$

According to Greene (2012) a proliferation of the parameters ( $\beta_{ij}$ ) are obtained by taking a second derivative of the likelihood function and this assertion is supported by Luo and Kanala (2008).

$$\frac{\partial^2 \ln(L)}{\partial^2 \beta} = - \frac{\sum_{i=1}^k [(\beta_{0j} + X_i \beta_{ij})(1 + e^{\beta_{0j} + X_i \beta_{ij}}) - (\beta_{0j} + X_i \beta_{ij})e^{\beta_{0j} + X_i \beta_{ij}}]}{(1 + e^{\beta_{0j} + X_i \beta_{ij}})^2} \quad (8)$$

$$\frac{\partial^2 \ln(L)}{\partial^2 \beta} = - \frac{\sum_{i=1}^k (\beta_{0j} + X_i \beta_{ij})}{(1 + e^{\beta_{0j} + X_i \beta_{ij}})^2} \quad (9)$$

Now let the required survey weight be  $w_s = 1/w_f$ , where  $w_f$  is the frequency

weight. The survey weight is inversely proportional to the frequency weight and  $w_f = c_i / \sum_i^n c_i$ ;  $c_i$  = size of class  $i$ . Introducing  $w_s$  into the empirical model looks exactly like the general regression with the weight as factor.

$$Y_{w_s} = w_s(\beta_{0j} + \beta_{ij}X_i + \varepsilon_{ij}) \tag{10}$$

If  $\varepsilon_{ij} = 0$ , the

$$Y_{w_s} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_j \\ \vdots \\ Y_J \end{bmatrix}, X_i = \begin{bmatrix} 1 & x_{11} & x_{12} & \dots & x_{1k} \\ 1 & x_{21} & x_{22} & \dots & x_{2k} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & x_{n2} & \dots & x_{nk} \end{bmatrix}, w_s\beta_j = \begin{bmatrix} w_1\beta_{0j} \\ w_2\beta_{1j} \\ \vdots \\ w_j\beta_{kj} \end{bmatrix}$$

From Equation (5), we have

$$l_{w_s} = \prod_{i=1}^{10} \left[ \frac{e^{(\beta_{0j} + X_i\beta_{ij})}}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right]^{w_s y_i} \left[ \frac{1}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right]^{w_s(1-y_i)} \tag{11}$$

$$l_{w_s} = \left[ \frac{e^{(\beta_{0j} + X_i\beta_{ij})}}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right]^{\sum_{i=1}^k w_s y_i} \left[ \frac{1}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right]^{\sum_{i=1}^k w_s(1-y_i)}$$

$$\ln(l_{w_s}) = \sum_{i=1}^k w_s y_i \left( \frac{e^{(\beta_{0j} + X_i\beta_{ij})}}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right) + \sum_{i=1}^k w_s(1 - y_i) \left( \frac{1}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right) \tag{12}$$

Hence, the maximum likelihood function proposed by Bhatta and Larsen (2011); Greene (2012) and here modified

$$\frac{\partial \ln(L)}{\partial \beta} = \left( \sum_{i=1}^k w_s X_i y_i \right) - \frac{w_s \sum_{i=1}^k (\beta_{0j} + X_i\beta_{ij})}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \tag{13}$$

$$= w_s \left[ \left( \sum_{i=1}^k X_i y_i \right) - \frac{\sum_{i=1}^k (\beta_{0j} + X_i\beta_{ij})}{1 + e^{(\beta_{0j} + X_i\beta_{ij})}} \right] \tag{14}$$

The second derivative of the modified model from Equation (9) is

$$\frac{\partial^2 \ln(L)}{\partial^2 \beta} = -w_s \frac{\sum_{i=1}^k (\beta_{0j} + X_i\beta_{ij})}{(1 + e^{\beta_{0j} + X_i\beta_{ij}})^2}$$

Hence, individual probabilities are:

$$\frac{P(Y_{w_s}=1)}{P(Y_{w_s}=J)} = e^{w_1(\beta_{01} + X_1\beta_{11} + X_2\beta_{21} + \dots + X_k\beta_{k1})} \tag{15}$$

$$\frac{P(Y_{w_s}=2)}{P(Y_{w_s}=J)} = e^{w_2(\beta_{02} + X_1\beta_{12} + X_2\beta_{22} + \dots + X_k\beta_{k2})} \tag{16}$$

$$\frac{P(Y_{w_s}=J-2)}{P(Y_{w_s}=J)} = e^{w_{J-2}(\beta_{0J-2} + X_1\beta_{1J-2} + X_2\beta_{2J-2} + \dots + X_k\beta_{kJ-2})} \tag{17}$$

$$\frac{P(Y_{w_s}=J-1)}{P(Y_{w_s}=J)} = e^{w_{J-1}(\beta_{0J-1} + X_1\beta_{1J-1} + X_2\beta_{2J-1} + \dots + X_k\beta_{kJ-1})} \tag{18}$$

## 2.2. The model’s odds ratios

The odds ratio quantifies the extent of association between two outcomes or events. The major purpose of the odds ratio  $e^{\beta_{ij}}$  is to forecast how independent variables will fall into the dependent variable categories. A smaller odds ratio ( $<1$ ) indicates a high probability of the event falling within the reference group (e.g., Commercial Driving). That is, there is a decreased probability that the independent variable will belong to the comparison group (e.g., TVET choices). A higher probability of the result in the comparison group is indicated by an odds ratio greater than 1 (Laurell et al., 2022). Given the probability that an individual selects Mechanical is  $p_1$ , and the probability that the remaining were selected is  $p_2$ . From Canan (2020), the following ratios could be developed:

- The odds of selecting Mechanical is  $\frac{p_1}{1-p_1}$
- The odds of selecting the other options is  $\frac{p_2}{1-p_2}$
- The odds ratio of selecting Mechanical vs other options is  $\frac{\frac{p_1}{1-p_1}}{\left(\frac{p_2}{1-p_2}\right)}$

**Table 1.** Variable name.

No.	Response Variable $Y_{w_s}$	$X_i$	Predictor Variable
1	Mechanical	$X_1$	Educational level
2	Electrical & Electronics	$X_2$	Financial problem
3	Hospitality	$X_3$	Parent influence
4	Building Construction	$X_4$	Peer influence
5	Woodwork	$X_5$	Teacher influence
6	Sewing	$X_6$	Academic performance
7	Beauticians	$X_7$	Vocational Limitations
8	Commercial Driving	$X_8$	Self-employed
-	-	$X_9$	Self-motivation
-	-	$X_{10}$	Lucrative nature of vocation

For example, in this experiment (refer: **Table 1**), about 63.44% of males and 36.56% of females, from different levels of education opted for TVET. Then, the

- Odds of males in a vocation is 1.735.
- Odds of females in vocation is 0.576.
- Hence, the odds ratio of males versus females in a vocation is 3.012.

This means that the odds of opting for TVET programmes is about 3 times greater for males than females. This could be due to traditional and societal underpinnings. Traditional gender roles and societal perceptions may have limited female participation in TVET in Ghana. For example, traditional gender roles in Ghana often associate males with technical and hands-on work, such as mechanics, construction, and engineering, which are commonly covered in TVET programmes. In contrast, females may be steered toward professions that align with caregiving, education, and office-based roles, which are less represented in TVET curricula. Also, TVET programmes in Ghana are perceived as more physically demanding and better suited



to males, while females may be encouraged to pursue more academically oriented or less physically intensive careers. These societal expectations can discourage females from considering TVET as a viable option. The lack of visible female role models in TVET-related fields can deter young women from pursuing such careers. If females do not see other women succeeding in technical professions, they may be less likely to envision themselves in similar roles.

Using the parameters of the weighted model, the sectorial odds ratios are determined as follows:

The odds or logit of a vocation =  $e^{w_s\beta_{ij}}$

Therefore, the odds of selecting Mechanical engineering is  $e^{w_1\beta_{i1}}$

The odds of selecting Electrical & Electronics engineering is  $e^{w_2\beta_{i2}}$

Also, the odds of opting to become a Beautician is  $e^{w_7\beta_{i7}}$

The Weighted models were therefore coded using R statistical software and subsequently analysed.

### 3. Explanation of variables

**Educational Level:** This variable refers to the highest level of formal education that a youth has completed. It can influence TVET decisions as different educational levels may correspond to different perceptions of vocational training. For example, youth with lower levels of education may see TVET as a more accessible pathway to employment, while those with higher educational attainment might view it as a backup option or an opportunity to specialize in technical skills.

**Financial Problem:** Financial constraints can significantly impact a youth's decision to pursue TVET. If a young person or their family faces economic difficulties, they may be more likely to choose vocational training, which is often perceived as a quicker and more affordable route to employment compared to traditional academic paths.

**Parent Influence:** Parental influence refers to the role that parents play in guiding or influencing their children's educational and career decisions. Parents may either encourage or discourage their children from pursuing TVET based on their own perceptions, experiences, and societal expectations. Positive parental support can increase the likelihood of a youth opting for TVET, while parental discouragement might steer them towards more academic or traditional career paths.

**Peer Influence:** Peer influence involves the impact of a youth's friends and social circle on their decision to opt for TVET. If a young person's peers are supportive of or actively pursuing vocational training, it can create a positive perception of TVET and encourage the youth to follow a similar path. Conversely, if peers look down upon vocational education, this could discourage participation in TVET.

**Teacher Influence:** Teacher influence refers to the guidance and advice provided by educators, which can shape a student's perception of TVET. Teachers play a crucial role in career counselling and may either promote TVET as a viable option or steer students towards academic tracks. The extent and nature of this influence can vary based on the teacher's own views of vocational education and their relationship with the student.

**Academic Performance:** Academic performance is a measure of how well a

student performs in school. Youth who struggle academically might see TVET as a more suitable option compared to traditional academic paths, which often require high performance in theoretical subjects. However, those with strong academic records may be less inclined to pursue TVET, viewing it as less prestigious than academic programmes like university degrees.

**Self-employed:** The desire to become self-employed can be a significant motivator for choosing TVET. Many vocational training programmes equip students with practical skills that are directly applicable to starting a business, such as carpentry, tailoring, or auto repair. Youth who aspire to run their own business may be more likely to opt for TVET, as it provides the hands-on experience and technical expertise needed for self-employment.

**Self-motivation:** Self-motivation refers to the internal drive and determination of youth to pursue a particular career path. Youth with strong self-motivation are more likely to opt for TVET if they have a clear vision of their future and believe that vocational training will help them achieve their goals. This factor reflects the youth’s personal aspirations and commitment to developing practical skills.

**Vocational Limitations:** This phrase is used in the context of scarce TVET programmes compelling youth to opt for the only available options within their community, even when these programmes do not align with their personal or career interests. This factor highlights the importance of expanding TVET opportunities and ensuring that a wider range of vocational training programs is accessible to all youth, regardless of their location.

**Lucrative Nature of Vocation:** This variable assesses the perception of how financially rewarding a particular vocation is. Youth who believe that a certain vocational field offers lucrative opportunities are more likely to opt for TVET. For instance, fields like plumbing, welding, or electrical work may be viewed as high-paying trades, which can attract youth seeking financial stability and success.

### 3.1. Preliminary findings

The preliminary results present the educational background of learners by sex—an area which is key to TVET decisions in Sub-Saharan Africa, particularly Ghana where it is generally perceived that the academically weak ones, venture into TVET programmes.

**Table 2.** Distribution of educational level of trainees by sex.

Educational Level	Male		Female		Total	
	Freq.	%	Freq.	%	Freq.	%
Primary School	83	8.18 (69.7)	36	6.15 (30.3)	119	7.44
Junior High School	637	62.76 (66.4)	322	55.04 (33.6)	959	59.94
Senior High School	138	13.60 (52.5)	125	21.37 (47.5)	263	16.44
Technical/Vocational	64	6.31 (48.1)	69	11.79 (51.9)	133	8.31
Tertiary	21	2.07 (84.0)	4	0.68 (16.0)	25	1.56
Non-Formal	72	7.09 (71.3)	29	4.96 (28.7)	101	6.31
Total	1015	100.0	585	100.0	1600	100.0

**Table 2** presents a detailed breakdown of the educational levels of trainees, disaggregated by sex. It reveals that many trainees, approximately 60%, have completed Junior High School (JHS). This group consists of 62.76% males and 55.04% females. Their significant representation highlights the need for targeted policy interventions to support and build on the educational foundation of this group. This demographic could serve as a focal point for policy development, particularly in relation to skill enhancement and continued education within TVET programmes.

A clear gender disparity emerges across all educational levels, with a particularly stark imbalance at the tertiary level. Here, males account for 84% of the trainees, while females make up only 16%. This pronounced gender gap at the tertiary level calls for urgent policy interventions aimed at promoting gender equality in advanced TVET education. Encouraging greater female participation at this level could address the broader issue of gender disparity in the workforce and contribute to more inclusive economic development.

The data also shows that only 1.56% of the total trainees have a tertiary education background. This highlights an opportunity to develop policies that encourage university students to consider TVET as a viable pathway, potentially broadening the appeal of these programmes to a more academically diverse population.

Interestingly, the gender distribution among trainees with Technical/Vocational education background is relatively balanced, with females slightly outnumbering males (51.9% to 48.1%). This near-parity suggests that TVET at this level may be more gender-inclusive compared to other educational levels. Policymakers could analyse what factors contribute to this balance and apply these insights to other levels to foster greater gender inclusivity throughout the entire TVET system.

Additionally, a significant proportion of trainees (7.09% of males and 4.96% of females) come from a non-formal education background. These trainees may face unique challenges and may require tailored support to succeed in TVET programmes. Policies such as the Ghana National Apprenticeship Policy 2020, could address the needs of trainees from non-traditional educational pathways and ensure that TVET systems are accessible and beneficial to all learners, regardless of their prior education. Also, in Ghana, the Commission for Technical and Vocational Education and Training (CTVET), established under Act, 2020 (Act 1023), mandated to regulate both pre-tertiary and private TVET institutions, must pay attention to this group of trainees.

### 3.2. Findings from the modified logit models

The findings of the modified logistic regression analysis for eight different vocations including the reference category, are shown together with the extent to which a predictor influences an individual's choice. The tables therefore present the intercepts ( $\beta_0$ ), standard errors ( $Se$ ), coefficients ( $\beta_j$ ), and  $p$ -values corresponding to each explanatory variable ( $x_1$  to  $x_{10}$ ). For a unit increase in the explanatory variable ( $X_i$ ), the multiplicative change in the probability of the result is represented by the odds ratio ( $e^{\beta_j}$ ).

**Table 3.** Modified logit models for hospitality and building construction.

Predictor	Hospitality				Building Construction			
	$\beta_j$	$e^{\beta_j}$	Se.	p-value	$\beta_j$	$e^{\beta_j}$	Se.	p-value
Intercept	0.286	1.331	0.23	$2.12 \times 10^{-1}$	-0.24	0.787	0.23	$2.87 \times 10^{-1}$
$x_1$	0.533	1.704	0.03	$3.59 \times 10^{-62}$	0.334	1.397	0.03	$1.40 \times 10^{-24}$
$x_2$	0.288	1.334	0.03	$5.86 \times 10^{-19}$	0.255	1.290	0.03	$1.66 \times 10^{-16}$
$x_3$	-0.79	0.454	0.04	$1.36 \times 10^{-6}$	-0.56	0.571	0.03	$3.61 \times 10^{-67}$
$x_4$	0.252	1.287	0.04	$3.62 \times 10^{-10}$	-0.02	0.980	0.04	$5.35 \times 10^{-1}$
$x_5$	-0.55	0.577	0.05	$3.61 \times 10^{-27}$	-0.42	0.657	0.05	$2.82 \times 10^{-17}$
$x_6$	0.007	1.007	0.04	$8.61 \times 10^{-1}$	-0.05	0.951	0.04	$1.62 \times 10^{-1}$
$x_7$	0.124	1.132	0.04	$2.88 \times 10^{-3}$	0.482	1.619	0.04	$1.89 \times 10^{-29}$
$x_8$	0.562	1.754	0.04	$3.30 \times 10^{-47}$	0.037	1.038	0.04	$3.79 \times 10^{-1}$
$x_9$	0.12	1.127	0.05	$9.88 \times 10^{-3}$	0.363	1.438	0.04	$6.66 \times 10^{-17}$
$x_{10}$	-0.51	0.600	0.04	$6.33 \times 10^{-40}$	-0.16	0.852	0.03	$2.38 \times 10^{-6}$

**Table 3** however looks at two distinct models to determine influential factors that determine the choices for either Hospitality or Building Construction. The “Hospitality” model revealed that educational level, financial problems, peers, self-employment, self-motivation and vocational limitations were a significant positive predictor of membership, suggesting that individuals with these characteristics were more likely to choose this vocation. Conversely, parents, teachers and the lucrateness of this TVET had a significant negative impact on membership, indicating that individuals influenced by these attributes were less likely to pursue a career in hospitality. Also, some trainees opted for hospitality due to limited vocational options. This means that trainees substituted hospitality with their interests that were not readily available. It is therefore imperative that the Ghana CTVET in union with the Ministry of Education expand TVET programmes to include all communities. Failure to do this may compel learners to continue to opt for programmes against their wish and thereby contribute to low productivity.

Similarly, in the “Building Construction” model, educational level, financial problems, self-employment, and self-motivation emerged as significant positive predictors, indicating that individuals were more likely to choose it. however, parents, teachers and lucrateness of this option had a significant negative influence on membership, suggesting that individuals with strong negative parental or teacher influence, were less likely to pursue a career in building construction. These factors rather facilitated the choice of “Commercial Driving” which looks lucrative because of the quick and immediate income the sector brings in, and thereby reducing immediate financial difficulties of parents.

In comparison, those who opted for hospitality or building construction were influenced by key factors such as educational level financial problems, self-employment, self-motivation and lucrateness of a vocation. Trainees with higher education are more likely to choose these careers, though financial difficulties can deter them. Nevertheless, social factors differ. For example, parental support is crucial in decision making. In contrast, peer influence has little effect on construction.

Overall, while educational level and financial problems are common factors, social factors play an important role in shaping career choices towards “commercial Driving” in particular.

To increase access to TVET education for individuals interested in hospitality, especially those facing financial challenges, it is recommended to implement targeted programmes like career counselling and financial aid including scholarships for learners. Additionally, peer mentoring programmes can provide valuable guidance and support for trainees considering careers in building construction.

**Table 4.** Modified logit models for mechanical and electrical & electronics engineering.

Predictor	Mechanical				Electrical & Electronics			
	$\beta_j$	$e^{\beta_j}$	Se.	p-value	$\beta_j$	$e^{\beta_j}$	Se.	p-value
Intercept	2.118	8.314	0.22	$3.20 \times 10^{-22}$	5.36	212.73	0.23	$5.97 \times 10^{-123}$
$x_1$	0.161	1.175	0.03	$1.99 \times 10^6$	0.14	1.150	0.04	$8.50 \times 10^{-5}$
$x_2$	0.25	1.284	0.03	$9.72 \times 10^{-16}$	0.179	1.196	0.03	$4.68 \times 10^{-8}$
$x_3$	-0.5	0.607	0.03	$6.17 \times 10^{-55}$	-0.76	0.468	0.04	$2.27 \times 10^{-100}$
$x_4$	0.08	1.083	0.04	$3.38 \times 10^{-2}$	0.097	1.102	0.04	$1.12 \times 10^{-2}$
$x_5$	-0.43	0.651	0.05	$1.32 \times 10^{-18}$	-0.65	0.522	0.05	$1.82 \times 10^{-41}$
$x_6$	-0.2	0.819	0.04	$8.88 \times 10^{-8}$	-0.33	0.719	0.04	$1.70 \times 10^{-19}$
$x_7$	0.011	1.011	0.04	$7.78 \times 10^{-1}$	-0.24	0.787	0.04	$3.51 \times 10^{-10}$
$x_8$	0.021	1.021	0.04	$6.30 \times 10^{-1}$	0.07	1.073	0.05	$1.41 \times 10^{-1}$
$x_9$	0.328	1.388	0.04	$2.24 \times 10^{-13}$	-0.49	0.613	0.07	$9.67 \times 10^{-14}$
$x_{10}$	-0.26	0.771	0.04	$5.32 \times 10^{-14}$	-0.17	0.844	0.04	$4.62 \times 10^{-6}$

Similarly, **Table 4** presents the results of two weighted multinomial logistic regression models, examining the relationship between various predictors and the likelihood of youth choosing “Mechanical” or “Electrical & Electronics” engineering relative to “Commercial Driving.” The relatively low baseline odds of 8.314 suggest that, when all other factors are considered as zero or at their reference levels, the probability of choosing “Mechanical” engineering is quite low. This might imply that other factors, such as educational level, financial problems, peers and vocational limitations in a geographical area or specific personal preferences, play a significant role in determining the choice of this field of engineering. This was supported by the fact that their corresponding p-values were less than the threshold (0.05). Again, this suggests that individuals with high educational background and strong financial problem are more likely to opt for this field. Also, in some communities, trainees were influenced to opt for “mechanical” engineering because, it wasn’t just a dominant TVET programme but that the other few ones available were not attractive to them. These geographical barriers and limited TVET options need serious consideration by stakeholders as mentioned earlier. If this is not checked, it can stifle other areas of economic growth and development.

Again, parents and teachers were found to have negative correlations with the likelihood of choosing “Mechanical” engineering. This suggests that parents facing financial difficulties, as well as teachers who guide and offer counselling services are more likely to influence learners to choose “Commercial Driving.”

In the case of the “Electrical & Electronics” engineering model, similar predictors turned out indicating similar interpretations and conclusions as in the case of “Mechanical” engineering option. Academic performance, self-motivation, teacher influence, and parental guidance were identified as significant predictors that negatively affected the choice of “Electrical & Electronics” engineering. This indicates that individuals with high academic performance or a strong self-motivation or positive teacher influence, and parental support are more likely to opt for “Commercial Driving” instead. This is evident from **Table 4**, supported by their low *p*-values less than the threshold (0.05).

Based on these findings, the following policy implications and recommendations can be considered: That CTVET must take steps to promote excellence by implementing modern/attractive skills and hands-on technology-driven training programmes to enhance TVET among the youth. They must make sure that a variety of TVET of programmes are available and accessible. In addition, it is advised that stakeholders provide opportunities for the youth to develop self-motivation and goal-setting skills.

Addressing financial barriers, CTVET and the Ministry of Education as well as industries such as UNILEVER Ghana could implement some financial aid and scholarships to reduce the impact of financial problems on TVET.

Enhancing teacher influence, it advised that teachers are Provided with professional development to equip them with the skills to inspire and guide students towards diversity of engineering and other related programmes careers.

Inevitably, strengthening parental support is crucial as parents to play an active role in supporting their children’s education and career aspirations. As they do so, they should be mindful to take their interest and aspirations into consideration.

**Table 5.** Modified logit models for Woodwork, sewing and Beauticians.

Predictor	Woodwork				Sewing				Beauticians			
	$\beta_j$	$e^{\beta_j}$	Se	P-value	$\beta_j$	$e^{\beta_j}$	Se	P-value	$\beta_j$	$e^{\beta_j}$	Se	P-value
Intercept	-0.13	0.878	0.23	$5.71 \times 10^{-1}$	0.724	2.063	0.25	$3.49 \times 10^{-3}$	1.342	3.827	0.25	$4.75 \times 10^{-8}$
$x_1$	0.037	1.038	0.04	$3.16 \times 10^{-1}$	0.203	1.225	0.03	$3.95 \times 10^{-9}$	0.019	1.019	0.04	$5.92 \times 10^{-1}$
$x_2$	0.335	1.398	0.03	$2.51 \times 10^{-28}$	0.072	1.075	0.03	$2.35 \times 10^{-2}$	0.199	1.220	0.03	$3.57 \times 10^{-11}$
$x_3$	-0.78	0.458	0.03	$1.95 \times 10^{-121}$	-0.57	0.566	0.03	$6.62 \times 10^{-74}$	-0.35	0.705	0.03	$3.19 \times 10^{-32}$
$x_4$	0.316	1.372	0.04	$2.23 \times 10^{-16}$	0.176	1.192	0.04	$3.05 \times 10^{-6}$	0.175	1.191	0.04	$3.05 \times 10^{-6}$
$x_5$	-0.19	0.827	0.05	$3.10 \times 10^{-4}$	-0.47	0.625	0.05	$1.37 \times 10^{-22}$	-0.4	0.670	0.05	$1.89 \times 10^{-16}$
$x_6$	0.006	1.006	0.04	$8.86 \times 10^{-1}$	0.041	1.042	0.04	$2.85 \times 10^{-1}$	-0.19	0.827	0.04	$1.26 \times 10^{-7}$
$x_7$	0.149	1.161	0.04	$2.72 \times 10^{-4}$	0.538	1.713	0.04	$3.66 \times 10^{-33}$	0.556	1.744	0.04	$9.24 \times 10^{-38}$
$x_8$	-0.19	0.827	0.05	$3.05 \times 10^{-5}$	-0.01	0.990	0.04	$7.39 \times 10^{-1}$	-0.55	0.577	0.06	$2.07 \times 10^{-19}$
$x_9$	0.309	1.362	0.04	$2.66 \times 10^{-12}$	-0.61	0.543	0.07	$3.00 \times 10^{-18}$	-0.3	0.741	0.06	$3.90 \times 10^{-6}$
$x_{10}$	0.049	1.050	0.03	$1.25 \times 10^{-1}$	-0.05	0.951	0.03	$8.63 \times 10^{-2}$	-0.12	0.887	0.03	$2.43 \times 10^{-4}$

**Table 5** presents the results of the weighted logistic regression models, examining the relationship between various predictors and the likelihood of youth choosing “Woodwork,” “Sewing,” or “Beauticians” as their vocation.

In **Table 5**, the weighted logistic regression models revealed the factors

influencing the likelihood of choosing “Woodwork,” “Sewing,” or “Beauticians” compared to “Commercial Driving.”

When all predictors are zero, the baseline odds of choosing “Woodwork,” “Sewing,” and “Beauticians” are 0.878, 2.063, and 3.827, respectively. This suggests that “Beauticians” has the highest baseline probability of being chosen, followed by “Sewing” and then “Woodwork.” That is, the higher the odds, the higher the probability of being selected. The low *p*-values (less than 0.05 threshold) recorded in **Table 5** for the three models indicate that several predictors are statistically significant in influencing the choice of vocation. For example, in the “Woodwork” model, only “Educational level,” “Academic performance,” and “Lucrativeness” were not significant. For the “Sewing” model, only “Academic performance,” “Self-motivation,” and “Lucrativeness” were not significant. For the “Beauticians” model, only “Educational level” was not significant. The low and consistent standard errors across all models confirm the precision of the estimates.

Key Findings therefore are that whilst “Financial Problems,” peers and one’s desire to be self-employed, largely influenced most youth to opt for “Woodwork,” “Sewing,” “Beauticians” parental and teacher influences were strong factors to determine their membership for “Commercial driving” instead.

To promote educational attainment, improve access to vocational training, foster self-motivation, address financial barriers, and enhance career guidance, policymakers can implement targeted interventions. These efforts can help youth make informed vocational choices and improve their livelihoods. For example, though educational level was less important for “woodwork” and “Beauticians,” targeted programmes could emphasize practical training and skill development. In addition, the desire to become self-employed was important for all three models, encouraging self-motivation can be beneficial for individuals considering various vocational paths, as it can help them overcome challenges and persevere.

#### **4. Discussions and conclusions**

The analysis of sampling-weighted MLR models revealed several significant predictors of vocational choices in the informal sector. These included “financial problems,” “parent influence,” “peer influence,” “teacher influence,” “self-motivation,” and “vocational limitations.”

Individuals facing financial difficulties were more likely to choose vocational careers that offered immediate income, such as “Commercial Driving.” This finding aligns with previous research by Boeren (2016) and King (2019), highlighting the economic constraints faced by youth in the informal sector. We think that financial challenges should not be a barrier to perusing a TVET programme of choice in the 21<sup>st</sup> century. The thinking of this research could not be far-fetched because, it aligns with the study in Uganda by Moses and Liu (2023), that TVET skill development plays a crucial role in transforming the informal sector in developing countries by equipping individuals with relevant skills and knowledge, that eventually promotes productivity, improve employment opportunities, and contribute to the overall development of the informal sector. They emphasised the importance of governments investing in TVET as a means of promoting economic growth and reducing poverty in developing

countries—the concern of many countries in Africa.

“Parent influence” and “peer influence” played significant roles in shaping vocational choices. Parents and teachers often influenced youth towards “Commercial Driving,” while peers could positively or negatively influence decisions. These findings emphasize the importance of social networks and support systems in career development.

Individual characteristics such as “Self-motivation” emerged as a crucial predictor, with positively influencing choices like “Woodwork,” “Mechanical,” “Hospitality,” and “Building Construction.” However, it negatively correlated with “Sewing,” “Beauticians,” and “Electrical & Electronics.” This suggests that self-motivated individuals are more likely to pursue vocations aligned with their interests and aspirations.

These outcomes agree with research conducted by Musset and Kurekova (2018), and Indecon (2019) in Ireland that parents, teachers and peers, have considerable influence on youth’s decision-making process towards career choice and implications for the job market. Musset and Kurekova (2018), who conducted their research under the auspices of the Organisation for Economic Co-operation and Development (OECD), however cautioned that teacher advice, though well-intentioned, may be biased towards higher education pathways.

Addressing vocational limitations, the limited availability of vocational training programmes and the lack of attractive options constrained many youths to choose vocations they might not have preferred. These findings are consistent with previous research by relevant studies, such as King (2019, 2020), highlighting the challenges faced by youth in accessing quality vocational education. A joint study by the World Bank, International Labour Organisation (ILO) and United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2023, also highlighted numerous challenges, including limited access to resources, job insecurity, and poor working conditions and suggested strategies to support the informal sector such as improving access to TVET and finance, providing business development training, and promoting formalization.

Interestingly, the lucrative nature and quick earnings associated with “Commercial Driving” influenced many youths to choose this vocation over other technical or vocational programmes. The opportunity to start as a driver’s mate and earn “chop money” during the learning period provided an attractive financial incentive. Perhaps, this motivated many parents and teachers to encourage the youth in this direction.

A concerning revelation was the significantly higher odds of opting for a TVET programme for males compared to females. This finding aligns with previous research by relevant studies, e.g., Najoli, (2019) identifying gender disparities in TVET and STEM education. This disparity if not addressed by stakeholders, can contribute to high unemployment rates among females and increase their dependency.

## **5. Recommendations**

Considering the challenges faced by youth in accessing vocational training and making informed career choices, several recommendations can be implemented. First,



promoting educational attainment and vocational training is crucial. Programmes should be developed to improve access to quality education, especially for females who often face additional barriers. These programmes must meet industry needs. This suggestion is consistent with the proposal by the International Labour Organization (ILO) report (2019), titled “Skills for Jobs: A Global Strategy for Technical and Vocational Education and Training (TVET),” that TVET education must align more closely with industry requirements, so they can significantly boost economic growth and job creation. This alignment can enhance the employability of graduates and contribute to sustainable development. Recent studies, jointly conducted by the World Bank, ILO and UNESCO in 2023 (World Bank, 2023), titled “Building Better Formal TVET Systems: Principles and Practice in Low- and Middle-Income Countries,” address the challenges and reforms in TVET in a similar way.

A more targeted approach could result in higher enrolment rates and more successful transitions into the labour market. However, the success of these efforts depends on the ability to maintain sustained engagement with youth and their influencers over time. For example, mentees who face financial challenges should be supported by grants, low-interest loans, or scholarships. Implementing this recommendation will require significant financial resources and strategic partnerships between the government, financial institutions, and development organizations. Establishing a transparent and equitable process for distributing financial aid could be challenging, and the risk of mismanagement or corruption must be mitigated. Monitoring and evaluation mechanisms will need to be established to ensure that financial support is effectively reaching the intended beneficiaries.

Furthermore, financial support could significantly reduce barriers to TVET participation for low-income youth, leading to increased enrolment and retention. However, the long-term impact will depend on the sustainability of these financial programmes and the ability of beneficiaries to repay loans or meet scholarship requirements.

In addition, we recommend that mentees should receive career counselling and guidance from teachers, career counsellors, and industry experts, but with caution against negative influences. Expanding career counselling services will require investment in training for teachers, counsellors, and industry experts to ensure they are equipped to provide accurate and impartial advice. The challenge lies in ensuring consistency and quality across diverse educational settings. Additionally, addressing negative influences, such as bias or misinformation, requires ongoing professional development and oversight.

However, effective career counselling can lead to better-aligned career choices, higher student satisfaction, and improved employment outcomes. But inconsistent implementation or insufficient training could undermine these benefits and perpetuate existing biases in career guidance.

Some key personalities are parents and peers. Parental and peer involvement should be encouraged in the TVET process through informational seminars, workshops, or parent-teacher conferences. Engaging parents and peers require consistent outreach efforts, including culturally sensitive and accessible communication strategies. Logistics, such as timing and location of workshops, must be carefully planned to accommodate diverse family structures and socioeconomic

conditions. Ensuring widespread participation may be difficult, particularly in rural areas or among less-educated populations. Increased parental and peer involvement could create a supportive environment for youth pursuing TVET, reducing the stigma associated with vocational education. However, the extent of the impact will depend on the quality and frequency of the engagement activities and the ability to shift long-standing cultural perceptions.

For motivation, trainers should be motivated by setting clear goals, offering feedback, and acknowledging technical and vocational achievements. Implementing motivation strategies for trainers will require collaboration with educational institutions and professional development programmes. Defining clear goals and providing constructive feedback necessitates regular evaluation mechanisms and a culture of continuous improvement. Financial and non-financial incentives should be explored, though budget constraints and varying institutional capacities may pose challenges.

Motivated trainers are more likely to deliver high-quality education, leading to better outcomes. However, the impact will vary depending on how effectively these motivation strategies are implemented and sustained over time.

Public and private partnerships should be strengthened to provide TVET that meets industrial needs. Building strong public-private partnerships requires alignment of interests between the government and the private sector. This involves regular dialogue, shared goals, and clear frameworks for collaboration. Ensuring that partnerships are equitable and mutually beneficial can be challenging, particularly in sectors with differing priorities. The government may need to provide incentives for private sector participation, such as tax breaks or subsidies.

Successful partnerships can help align TVET curricula with market demands, improving employment outcomes for graduates. However, the risk of focusing too narrowly on the immediate needs of industry, at the expense of broader educational objectives, must be managed.

More importantly, CTNET should operationalize the Ghana National TVET Policy (2020) through active advocacy to attract more youth, especially females. Operationalizing the National TVET Policy will require a coordinated effort from government bodies, educational institutions, and advocacy groups. Active advocacy campaigns must be well-funded and carefully targeted to reach underrepresented groups, such as females. Implementation challenges may include overcoming cultural barriers, ensuring equitable access to programmes, and securing long-term funding for advocacy efforts. Successfully operationalizing the policy could lead to increased enrolment in TVET programmes, particularly among females, thereby addressing gender disparities. The broader impact will depend on the effectiveness of the advocacy campaigns and the extent to which they can shift societal perceptions of TVET as a viable and attractive career path for all youth.

In Conclusion, this research highlights the complex factors influencing vocational choices in the informal sector. By addressing these challenges and implementing targeted interventions, policymakers can enhance livelihoods and promote economic development.

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## References

- Abdul Hamid, H., Bee Wah, Y., Xie, X.-J., et al. (2017). Investigating the power of goodness-of-fit tests for multinomial logistic regression. *Communications in Statistics - Simulation and Computation*, 47(4), 1039–1055.  
<https://doi.org/10.1080/03610918.2017.1303727>
- Agresti, A. (2019). *An introduction to categorical data analysis*. John Wiley & Sons. pp. 89-106, 159-166.
- Agyemang, K., & Amoako, E. (2023). The Impact of TVET on Ghana's Socio-Economic Development: A Case Study of ICCES. *Journal of Vocational Education and Training*, 15(2), 1-15.
- Alvi, M. (2016). *A manual for selecting sampling techniques in research*. MPRA Paper.
- Archer, K. J., & Lemeshow, S. (2006). Goodness-of-fit Test for a Logistic Regression Model Fitted using Survey Sample Data. *The Stata Journal: Promoting Communications on Statistics and Stata*, 6(1), 97–105.  
<https://doi.org/10.1177/1536867x0600600106>
- Bhatta, B. P., & Larsen, O. I. (2011). Errors in variables in multinomial choice modeling: A simulation study applied to a multinomial logit model of travel mode choice. *Transport Policy*, 18(2), 326–335.  
<https://doi.org/10.1016/j.tranpol.2010.10.002>
- Bisht, N., & Pattanaik, F. (2020). Exploring the magnitude of inclusion of Indian youth in the world of work based on choices of educational attainment. *Journal of Economics and Development*, 23(2), 128–143. <https://doi.org/10.1108/jed-08-2020-0114>
- Boeren, E. (2016). *Lifelong Learning Participation in a Changing Policy Context*. Palgrave Macmillan UK.  
<https://doi.org/10.1057/9781137441836>
- Buba, A., Somasundara, J. W. D., Adamu, I., et al. (2022). Vocational Training and Youth Empowerment in Nigeria: Evidence from Informal Sector Operators' Activity in Gombe Metropolis. *American Journal of Social Sciences and Humanities*, 7(2), 144–153. <https://doi.org/10.55284/ajssh.v7i2.799>
- Chelimo, W. K. C. (2022). *Leadership Styles and Competency Development in Technical and Vocational Education and Training Institutions in Kenya*. Available online:  
<http://ir.jkuat.ac.ke/bitstream/handle/123456789/5983/REFORMATING%20THE%20%20LAYOUT%20AND%20TABLE%20Wilson%20Chelimo34.pdf?sequence=1&isAllowed=y> (accessed on 2 June 2024).
- Chen, M. A. (2006). Rethinking the informal economy: linkages with the formal economy and the formal regulatory environment. *Linking the Formal and Informal Economy*, 75–92. <https://doi.org/10.1093/0199204764.003.0005>
- Cirillo, M. A., & Ramos, P. S. (2014). *Goodness-of-fit Tests for Modified Multinomial Logit Models*. Available online:  
[https://soche.cl/chjs/volumes/05/01/Cirillo\\_Ramos\(2014\).pdf](https://soche.cl/chjs/volumes/05/01/Cirillo_Ramos(2014).pdf) (accessed on 2 June 2024).
- Deissinger, T. (2019). The Sustainability of the Dual System Approach to VET. In: *The Wiley Handbook of Vocational Education and Training*. Wiley. pp. 293–310. <https://doi.org/10.1002/9781119098713.ch15>
- Ghosh, M. (2013). Mathematical Modelling of Malaria with Treatment. *Advances in Applied Mathematics and Mechanics*, 5(06), 857–871. <https://doi.org/10.4208/aamm.12-m12137>
- Greene, W. H. (2012). *Econometric Analysis*. Prentice Hall.
- Handbook of Career Development*. (2014). International and Cultural Psychology. Springer New York.  
<https://doi.org/10.1007/978-1-4614-9460-7>
- Haseloff, G., Eicker, F., & Lennartz, B. (2017). *Vocational Education and Training in Sub-Saharan Africa*. wbv Publikation.  
<https://doi.org/10.3278/6004570w>
- Indecon International Economic Consultants (2019). *Indecon Review of Career Guidance*. Available online:  
<https://www.gov.ie/pdf/?file=https://assets.gov.ie/24951/dffde726604b451aa6cc50239a375299.pdf#page=null> (accessed on

- 3 September 2024).
- International Labour Organization (ILO). (2019). *Skills for Jobs: A Global Strategy for Technical and Vocational Education and Training (TVET)*. ILO Publications.
- King, K. (2019). *Education, Skills and International Cooperation*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-29790-9>
- King, K. (2020). Skills development and the informal sector: a review of reports and commitments of the international institutions. In: *Research Handbook on Development and the Informal Economy*. Edward Elgar Publishing. <https://doi.org/10.4337/9781788972802.00025>
- Kisielewska, M. M. (2014). *Organisation for economic co-operation and development*. Chilean Statistical Society {Sociedad Chilena de Estadística.
- Koç., S. T. (2020). *Current Researches n Health Sciences Editors*. Available online: <https://www.researchgate.net/profile/Serim-Koc/publication/342571444> (accessed on 2 June 2024).
- Korang, V. (2021). Apprenticeship skills development within the informal sector of the Ghanaian economy: the case of sunyani magazine. *UDS International Journal of Development*, 8(1), 559–572. <https://doi.org/10.47740/564.udsijd6i>
- Kuha, J., & Mills, C. (2018). On Group Comparisons with Logistic Regression Models. *Sociological Methods & Research*, 49(2), 498–525. <https://doi.org/10.1177/0049124117747306>
- Laurell, J., Gholami, K., Tirri, K., et al. (2022). How Mindsets, Academic Performance, and Gender Predict Finnish Students' Educational Aspirations. *Education Sciences*, 12(11), 809. <https://doi.org/10.3390/educsci12110809>
- Li, J., Xue, F., Xu, X., et al. (2020). Dynamic contrast-enhanced MRI differentiates hepatocellular carcinoma from hepatic metastasis of rectal cancer by extracting pharmacokinetic parameters and radiomic features. *Experimental and Therapeutic Medicine*. <https://doi.org/10.3892/etm.2020.9115>
- Li, Y., & Fan, W. (David). (2019). Modelling severity of pedestrian-injury in pedestrian-vehicle crashes with latent class clustering and partial proportional odds model: A case study of North Carolina. *Accident Analysis & Prevention*, 131, 284–296. <https://doi.org/10.1016/j.aap.2019.07.008>
- Liu, H.-F., Lu, Y., Wang, Q., et al. (2023). Machine Learning-Based CEMRI Radiomics Integrating LI-RADS Features Achieves Optimal Evaluation of Hepatocellular Carcinoma Differentiation. *Journal of Hepatocellular Carcinoma*, 10, 2103–2115. <https://doi.org/10.2147/jhc.s434895>
- Luo, J., & Kanala, N. K. (2008). Modeling urban growth with geographically weighted multinomial logistic regression. In: *Proceedings of the Geoinformatics 2008 and Joint Conference on GIS and Built Environment: The Built Environment and Its Dynamics*. <https://doi.org/10.1117/12.812714>
- Melak, D., & Derbe, T. (2022). Analysis of determinants of youth self-employment career choices. *Journal of Small Business and Enterprise Development*, 29(6), 886–901. <https://doi.org/10.1108/jsbed-10-2021-0435>
- Moses, K. M., & Liu, W.-T. (2023). The Role of TVET Skill Development in Transformation of Informal Sector in Developing Countries: The Case Study of Skilling Uganda Program in Kampala Urban Area Uganda. *ICVEAST*. <https://doi.org/10.3390/proceedings2022083046>
- Mugoda, S., Esaku, S., Nakimu, R. K., et al. (2020). The portrait of Uganda's informal sector: What main obstacles do the sector face? *Cogent Economics & Finance*, 8(1), 1843255. <https://doi.org/10.1080/23322039.2020.1843255>
- Musset, P., Kurekova, L.M., (2018). *Working it out: Career guidance and employer engagement*. OECD Education Working Papers.
- Najoli, E. K. (2019). The Effectiveness of Wited Programme on Enrollment of Women in Technical and Vocational Education and Training (TVET). *EURASIA Journal of Mathematics, Science and Technology Education*, 15(3). <https://doi.org/10.29333/ejmste/103034>
- Norain Jaafar, S., Zakaria, N., & Abd Rasheid, N. (2018). Career Choice and Employability Skills for Vocational College Students. *Journal of Physics: Conference Series*, 1049, 012050. <https://doi.org/10.1088/1742-6596/1049/1/012050>
- Oluwatoyin Adewale, P. (2017). Factors Affecting Polytechnic Students' Perception of Building-Based Vocational Skills. *International Journal of Vocational Education and Training Research*, 3(4), 29. <https://doi.org/10.11648/j.ijvetr.20170304.11>
- Owusu-Agyeman, Y., & Aryeh-Adjei, A. A. (2023). The development of green skills for the informal sector of Ghana: towards sustainable futures. *Journal of Vocational Education & Training*, 76(2), 406–429. <https://doi.org/10.1080/13636820.2023.2238270>
- Paul, P., Berlin, C., Maessen, M., et al. (2018). A comparison of regret-based and utility-based discrete choice modelling – an

- empirical illustration with hospital bed choice. *Applied Economics*, 50(40), 4295–4305.  
<https://doi.org/10.1080/00036846.2018.1444260>
- Pongo, N. A., Effah, B., Osei-Owusu, B., et al. (2014). The impact of TVET on Ghana’s socio-economic development: a case study of ICCES TVET skills training in two regions of Ghana. *American International Journal of Contemporary Research*, 4(1), 185-192.
- Ragazou, K., Passas, I., Garefalakis, A., et al. (2022). Youth’s Entrepreneurial Intention: A Multinomial Logistic Regression Analysis of the Factors Influencing Greek HEI Students in Time of Crisis. *Sustainability*, 14(20), 13164.  
<https://doi.org/10.3390/su142013164>
- SHEN, J., WANG, Q., WANG, J., et al. (2015). Analysis of soluble urokinase plasminogen activator receptor in multiple myeloma for predicting prognosis. *Oncology Letters*, 10(4), 2403–2409. <https://doi.org/10.3892/ol.2015.3613>
- Sifringer, B., Lurkin, V., & Alahi, A. (2020). Enhancing discrete choice models with representation learning. *Transportation Research Part B: Methodological*, 140, 236–261. <https://doi.org/10.1016/j.trb.2020.08.006>
- Vanek, J. (2014). Statistics on the informal economy definitions, regional estimates and challenges. WIEGO.
- World Bank, International Labour Organization (ILO), UNESCO. (2023). “Building Better Formal TVET Systems: Principles and Practice in Low- and Middle-Income Countries. Available online:  
<https://www.worldbank.org/en/topic/skillsdevelopment/publication/better-technical-vocational-education-training-TVET>  
(accessed on 2 June 2024).