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From Classroom to Factory Floor: Assessing the Efficacy of Technology Transfer in Electrical Tvet Programs Across Greater Accra, Ashanti, and Eastern Regions

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ABSTRACT

This paper explores the effectiveness of technology transfer in electrical TVET programs in Ghana in three main industrial zones. The quantitative, cross-sectional design was used, based on graduate and employer data in Greater Accra, Ashanti, and Eastern regions. Based on the Triple Helix Model, the research evaluated alignment and transition of graduates into engineering jobs. Results indicate that there has been a continued lack of alignment between what is taught in the classrooms and the competency demands on the factory-floor. The average scores of the relevance of the curriculum were lower than the Likert midpoint in all three regions. There were also employment transition rates of between 22.4 and 41.6 in the Eastern region and Greater Accra, respectively. The policy recommendations will be addressed to the Ministry of Education and the technical universities in the regions.

Keywords: Curriculum alignment, electrical engineering, industrial placement, technology transfer, Triple Helix, TVET

INTRODUCTION

Akyeampong (2009) frames the Ghana TVET system as a post-colonial legacy that has been influenced by changing development priorities. The industry has since been redefined to meet the current industrial labour needs. According to Mugabirwe et al. (2025), the TVET systems in sub-Saharan Africa experience chronic underinvestment in practical infrastructure. The industrial environment in Ghana is greatly concentrated in three major economic regions, namely Greater Accra, Ashanti, and Eastern. According to Lamptey (2022), these areas are considered the major manufacturing areas, and they host more than 70% of registered manufacturing enterprises. The industrial activity in Accra includes electronics assembly and light manufacturing, whereas Kumasi is known to produce metalwork and engineering fabrication.

Additionally, Amedorme and Fiagbe (2013) reported severe deficiencies in electrical TVET programmes in Ghana, such as old laboratory facilities. The Eastern region facilitates agro-processing, electrical fitting and small-scale industrial production. However, Ntetha and Taole (2025) believe that TVET institutions are better placed to fill the skills gap. But there is still an obstinately wide gap between the theory of the classroom and the needs of the factory floor. According to UNESCO (2015), this misalignment is discussed as a world crisis of job relevance, which is particularly sharp in developing economies. Graduates are usually joining the job market without the required practical skills, which the current Ghanaian manufacturers need.

Nevertheless, a long-standing lack of alignment between classroom training in TVET and the technical needs of factories has been widely reported. According to Owusu-Ansah (2024), this is a failure of design in vocational

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curriculum in West Africa. According to Chiamogu and Chiamogu (2025), more than 65% of manufacturing companies in Ghana were found to be dissatisfied with the new TVET graduate preparedness. Graduates of electrical engineering often do not have practical skills in automated systems and programmable logic controllers. Ekuma (2019) attributes this weakness to the historical supremacy of theory-based pedagogy in technical institutions in Ghana. The issue is particularly severe in the Eastern area, where the growth of industry in the area exceeds the number of qualified graduates.

Owusu-Agyeman et al. (2025) affirm that the cycles of curriculum review at Ghanaian TVET institutions are infrequent and seldom industry-based. A West African economy's productivity loss of up to 3 per cent of yearly GDP was estimated by the World Bank (2014) as a result of skills mismatches. Lamptey (2022) attributes graduate inadequacy to the old laboratory infrastructure and overly theory-laden curricula. Oketch (2007) argues further that the lack of strong tracer studies constrains the institutional responsiveness to the changes in the labour market. This research directly talks of these gaps by producing comparative empirical data in three economic regions.

This study assesses how effectively electrical engineering skills are transferred from TVET schools to the workplace. Ntetha and Taole (2025) highlight the urgency of such an assessment due to the targets of industrialisation in Ghana. The investigation is guided by two particular research objectives. The research will first analyse how the existing TVET curriculum is aligned with the industrial needs in the three regions. Second, the research analyses the rate at which electrical engineering graduates are developing into core engineering jobs. As Lauglo (2005) affirm, such dual-objective models generate actionable policy-relevant evidence to reform TVET.

The national industrialisation agenda of Ghana is heavily reliant on a technically capable workforce. Lamptey (2022) places TVET reform as the key to the Ghana Beyond Aid development framework. Aggarwal and Mani (2025) posit that enhanced systems in vocational training will always minimise unemployment among the youth in the developing economies. The transfer of technology in TVET programs can be enhanced to lower the cost of recruitment by manufacturing firms in need of skilled electrical technicians. Mugabirwe et al. (2025) also mention that investments in the TVET infrastructure have greater effects in terms of employment multiplier than general education does. The findings of this study can thus apply to policymakers, curriculum developers, and even industry leaders.

The paper consists of six distinct sections. Section 2 provides a literature review which introduces the theoretical and conceptual frameworks. The research methodology is described in Section 3 together with the sampling method and data collection instruments. The study results are presented in Section 4, which organises findings according to two research objectives. The existing studies link the results of Section 5 through a critical analysis of the findings. Section 6 presents research suggestions and future study directions which are supported by evidence.

LITERATURE REVIEW

Theoretical Framework

The Triple Helix Model introduced by Etzkowitz and Leydesdorff (1995) explains how innovation systems produce knowledge. The model shows how three parts, which include academia, industry, and government, work together to drive technological development. Etzkowitz (2003) extended the model to vocational education, arguing that skill production requires the same tripartite alignment. Addy et al. (2025) use the model to show how academia, industry and government work together in Ghana's TVET sector. The model shows that universities create knowledge and train skilled graduates who will work in industry. The industry sector gives feedback about the necessary skills while it employs trained workers.

The government serves as the intermediary which controls regulations and provides funds to support institutional partnerships. Ranga and Etzkowitz (2013) argue that the model is especially useful for developing nations which experience difficulties in connecting these three main groups. The Triple Helix framework shows Ghanaian

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TVET system weaknesses which affect all three of its operational areas. Addy et al. (2025) show that academic institutions and industries throughout Ghana maintain their communication through informal channels, which lack standardisation across different regions. Owusu-Ansah (2024) states that factories and TVET institutions need structured feedback systems to solve their ongoing skill mismatch problem. The model shows why technology transfer fails to achieve its intended results despite existing policy objectives.

EMPIRICAL REVIEW

Curriculum Alignment with Industrial Needs

Ntetha and Taole (2025) reviewed curricula across five West African nations and found widespread use of outdated syllabi. The electrical TVET programs of Ghana showed insufficient coverage of automation technologies, PLC systems and renewable energy systems. Lamptey (2022) confirmed that industrial supervisors in Accra rated over 60% of graduate competencies as inadequate. The researchers, Owusu-Agyeman et al. (2025), explain that the Ghanaian national curriculum review process lacks industry consultation requirements. Amedorme and Fiagbe (2013) earlier identified the same gap, noting that curriculum updates lagged industrial changes by six to ten years. The findings demonstrate that Ghanaian TVET institutions experience a complete breakdown of their curriculum review process.

The research from King and Palmer (2010) demonstrates that demand-driven TVET systems deliver better graduate employment outcomes. The vocational electrical programs from Nigeria and Senegal demonstrate identical delays in their curriculum development process. Government authorities in West Africa have delayed their implementation of mandatory industry-based curriculum updates (Addy et al., 2025). Chiamogu and Chiamogu (2025) discovered that electrical TVET institutions in Kumasi had not implemented renewable energy training programs, which the industry required. Lauglo (2005) recommend that educational institutions conduct regular tracer studies because these studies help bridge the gap between academic programs and industry requirements. The existing evidence establishes that Ghanaian TVET institutions require a continuous and mandatory process for conducting curriculum alignment activities.

Graduate Transition into Engineering Roles

According to Ntetha and Taole (2025), less than 35% of Ghanaian electrical TVET graduates find engineering employment within their first two years after completing their studies. Oketch (2007) explains that this situation exists because TVET institutions maintain insufficient placement connections with manufacturing companies. Ekuma (2019) discovered that Ghanaian employers prefer to hire from universities because they believe TVET graduates lack the necessary skills. World Bank (2014) reported that informal self-employment represents the primary employment option for TVET graduates who do not obtain formal engineering jobs. Aggarwal and Mani (2025) proved through their research on South Asia and West Africa that compulsory apprenticeship programs lead to higher rates of formal job placement for workers. The studies demonstrate that the transition problem exists because of two separate issues, which include structural problems and deficiencies within the curriculum.

Addy et al. (2025) discovered that Greater Accra graduates achieved their highest rate of official job placements because manufacturing companies operated in their area. Ashanti graduates received moderate employment in Kumasi, which operates automotive and metalwork industries, according to Owusu-Agyeman et al. (2025). The Eastern region shows the lowest transition rates according to Owusu-Ansah (2024) because it has fewer formal industrial employers. Akyeampong (2009) argues that regional differences in TVET outcomes exist because of Ghana's spatial development inequalities, which affect all areas of the country. The different regions require separate policies for technology transfer because of their distinct characteristics, which need to be addressed.

Research Gaps

The current body of research lacks comparative studies that use data from multiple regions to examine the technology transfer of TVET programs in Ghana. Addy et al. (2025) note that the majority of the Ghanaian TVET research is limited to the Greater Accra region. The Ashanti and Eastern regions are still underrepresented in peer-reviewed research in vocational education. According to Ntetha and Taole (2025), quantitative research to

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compare the perceptions of employers and graduates in various regions does not exist. According to Chiamogu and Chiamogu (2025), there are no studies that utilise both graduate and employer datasets at the same time. The present research study is a one of its kind of evaluation since it analyses both the relevance of the curriculum and the placement results of three different regions.

Conceptual Framework

The conceptual framework training inputs (institutional training) produce the outcomes of industrial technology transfer through their developed pathway. Lamptey (2022) identifies curriculum quality and institutional capacity as the two principal filters which control this process. The structural logic of the three input nodes, namely, the quality of the TVET institution, the government policy, and the demand in the industry, is presented by Etzkowitz and Leydesdorff (1998). The curricula are industry-approved, and thus graduate students with the necessary skills needed in the workplace. The institutional ability and placement machinery are effective in steering those graduates into appropriate engineering jobs. The outcome variable is the technology transfer efficacy score, which measures graduate competencies in terms of rating scores and level of employment improvement.

The research makes comparisons between the regions based on their level of efficacy as the primary basis of comparison. Ranga and Etzkowitz (2013) affirm that the level of Triple Helix interactions is moderated by the density of industry in a region. The theoretical framework also predicts that the areas that have higher industrial representation will gain higher results of technology transfer efficacy. The visual conceptual map created in this research can be presented in its entire visual form in Figure 1, which is shown below.

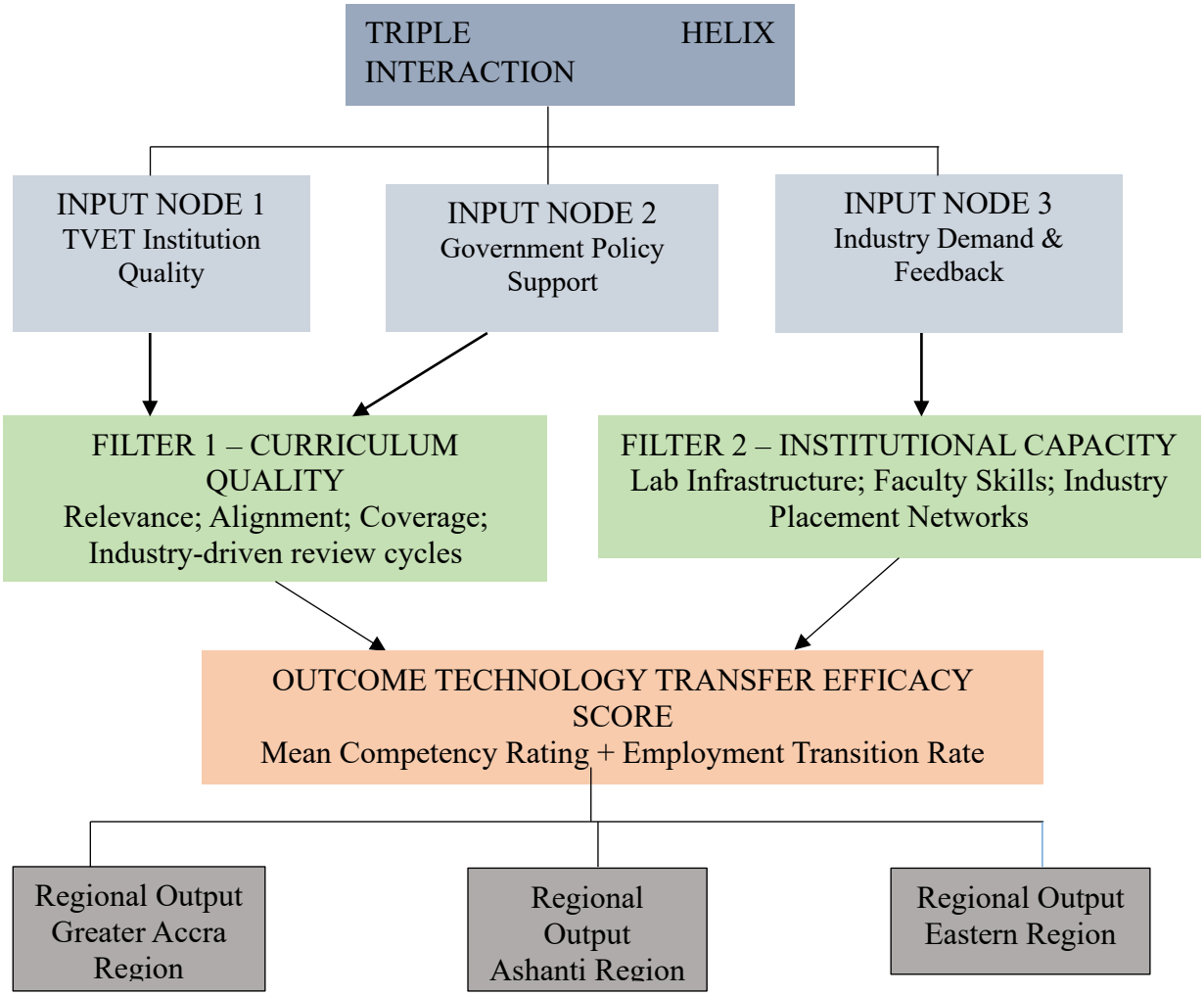

Figure 1. Conceptual Framework: Technology Transfer Efficacy in Electrical TVET Programs Source: Author's Construct, 2025

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METHODS AND MATERIALS

Research Design

The study employs quantitative research methods through its application of a comparative cross-sectional research design. Cross-sectional research designs function as the most suitable method for studying institutional performance across diverse geographic regions, according to Weyant (2022). The comparative dimension enables researchers to use statistical methods for testing technology transfer effectiveness across three different regions of Ghana. Ntetha and Taole (2025) confirm that quantitative designs are appropriate for generating policy-relevant TVET evidence in developing country contexts. Khosla (2021) emphasises that cross-sectional surveys serve as valuable research tools which scientists use to create results that apply to entire populations about workforce readiness indicators.

Target Population

The target population consists of electrical engineering graduates from TVET programs and industrial human resource managers. The study of workforce readiness needs to include both supply-side and demand-side actors, according to Lamptey (2022). The researchers selected their participants from accredited technical institutions located in Accra, Kumasi, and Koforidua. The researchers selected human resource managers from manufacturing companies that had registered their businesses in all three regions. Chiamogu and Chiamogu (2025) used a similar dual-stakeholder framework to study TVET outcomes in the Ashanti region.

Sample Size Determination Using Yamane's Formula

Yamane (1967) developed the sampling formula:

$$n = \frac{N}{(1 + N(e^2))}$$

where N is the population and e is the margin of error. The graduate population across three regions was estimated at 1,200, thus requiring 300 graduates as the sample size. HR managers needed 250 firms as their study sample, which produced 154 usable responses. Addy et al. (2025) support the formula by Yamane due to its reliability and ease in social science research settings. As affirmed by Khosla (2021), the margin of error that is suitable in the comparative educational research designs is a 5% margin of error.

Sampling Technique

This was done by stratified random sampling to ensure that every region would contribute their respective share of participants. Weyant (2022) rationalises stratification as necessary when comparing subgroups in a heterogeneous population. The three regions which comprised the strata of both graduates and employers were: Greater Accra, Ashanti and Eastern. The researchers employed the simple random sampling technique in selecting respondents in both institutional and firm directories. The same stratified approach was adopted by Ntetha and Taole (2025) in their comparative study of West African TVET programmes, which supports its application in this study.

Data Collection Instruments

Questionnaires were structured to determine the transfer of skills and competency at workplace among both groups of respondents. Owusu-Ansah (2024) shows that structured Likert-scale questionnaires yield reliable and measurable data that can be used by researchers in their studies of vocational education. The graduate questionnaire had 12 questions about the relevance of the curriculum, the quality of practical training, and workplace preparedness. The employer questionnaire also determined the performance of graduates in 10 technical competency indicators. To ensure that a holistic assessment is conducted, King and Palmer (2010) suggest that employer-facing instruments should be designed to have both technical and transferable skills items to assess the skill holistically.

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Reliability Testing

Cronbach's Alpha was used in the study to evaluate the internal consistency reliability of their measurement scales. Lamptey (2022) establishes a reliability limit of $\alpha \geq 0.70$ as an acceptable reliability of social science instruments. The researchers conducted a pilot test, which included 30 participants, before they started their main data collection. Table 1, just below this sentence, provides the pilot study analysis of the reliability of each scale tested.

Table 1. Cronbach's Alpha Reliability Statistics for Measurement Scales

Scale / Sub-scale	No. of Items	Cronbach's Alpha (α)
Curriculum Alignment Scale (Graduates)	12	0.82
Workplace Competency Scale (Employers)	10	0.79
Technology Transfer Index (Combined)	22	0.84

The curriculum alignment scale had an alpha value of 0.82, which was higher than the acceptable threshold for the results. The competency assessment scale generated an alpha value of 0.79, which gave it adequate reliability to be used in its assessment. The overall technology transfer index had an alpha of 0.84, which indicated a high internal consistency of the measurement.

Data Analysis

SPSS version 27 was used for all statistical analyses, including descriptive statistics and independent samples T-tests. According to Addy et al. (2025), SPSS is the analysis platform of choice in comparative research on TVET in West Africa. Weyant (2022) characterises independent samples T-tests as suitable for comparing the mean scores of different regional groups. All inferential tests performed in this study had a statistical significance of $p < 0.05$.

Ethical Considerations

Informed written consent was given by all participants prior to the questionnaire being filled out. Khosla (2021) emphasises that social research needs both voluntary participation and data anonymity as its main ethical standards. In conducting the study, the research team did not collect any personally identifiable information on graduate students or their employers. The principal investigator was the only one with access to the encrypted drives, and all the data was there. The research team received institutional ethical approval from the university research ethics board before commencing their fieldwork.

RESULTS

Demographic Characteristics of Respondents

A total of 454 respondents participated in the study, comprising 300 graduates and 154 industry HR managers. Table 2 presents the demographic profile of all respondents across both groups.

Table 2. Demographic Characteristics of Respondents (N = 454)

Variable	Category	Frequency	Percentage
Gender	Male	324	71.3%
	Female	130	28.7%
Age (Graduates)	21–30 years	204	68.0%
	31–40 years	72	24.0%
	Above 40 years	24	8.0%
Qualification	TVET Certificate	252	84.0%
	Post-TVET Technical	48	16.0%
Firm Size (Employers)	Medium (50–250 workers)	93	60.4%

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	Large (>250 workers)	61	39.6%
Region (Graduates)	Greater Accra	101	33.7%
	Ashanti	100	33.3%
	Eastern	99	33.0%

Source: Field Data (2026)

The male graduate percentage reached 71.3% while the female graduate percentage reached 28.7%, which matched the gender distribution of Ghanaian TVET programs. The majority of graduates (68%) were between 21 and 30 years, indicating a predominantly young respondent base. The HR managers included 60.4% of their workforce from medium-sized enterprises and 39.6% from large enterprises. The near-equal regional distribution of graduates confirms the effectiveness of the stratified sampling approach.

Curriculum Alignment with Industrial Needs

Curriculum Relevance Mean Scores by Region

Graduates and employers in all three regions rated curriculum relevance using a five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Table 3 shows the descriptive statistics for curriculum relevance and competency adequacy ratings, which were collected from different regions and respondent groups.

Table 3. Descriptive Statistics for Curriculum Relevance and Employer Competency Ratings by Region

Region	Respondent Group	N	Mean	SD	Min	Max
Greater Accra	Graduates	101	2.61	0.74	1.0	4.5
Greater Accra	Employers	54	2.53	0.77	1.0	4.0
Ashanti	Graduates	100	2.74	0.81	1.0	4.5
Ashanti	Employers	52	2.79	0.82	1.0	4.5
Eastern	Graduates	99	2.48	0.69	1.0	4.0
Eastern	Employers	48	2.31	0.65	1.0	3.5

Source: Field Data (2026)

The graduates from Greater Accra obtained an average curriculum relevance score of 2.61, which showed a standard deviation of 0.74, which demonstrated that they perceived the curriculum to match their needs below the average level. The Ashanti graduates achieved the highest score with their average rating of 2.74, which showed a standard deviation of 0.81, which researchers believe results from the diverse industrial landscape that exists in Kumasi. The Eastern region graduates achieved the lowest curriculum relevance score with a mean score of 2.48, which had a standard deviation of 0.69 among the three groups. The employer ratings followed the same regional pattern, with Ashanti firms rating graduate competencies highest (M = 2.79) and Eastern firms lowest (M = 2.31). Less than 30% of employers in all three regions assessed graduates as sufficiently competent in their fundamental engineering duties.

Competency Gaps Identified by Employers

Employers were asked to identify the most critical competency gaps among TVET graduates they had recruited. Table 4 shows the ranking of competency deficits which employer respondents reported across three different regions.

Table 4. Competency Gaps in Electrical TVET Graduates as Reported by Industry Employers *(N = 154)*

Competency Gap	Employers Citing (%)	Rank
Operation of CNC/PLC-based machinery	78.6	1st
Industrial safety protocol compliance	65.4	2nd

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Fault diagnosis in automated systems	58.3	3rd
Reading of electrical engineering drawings	52.7	4th
Energy management systems knowledge	47.1	5th
Renewable/solar energy system installation	41.8	6th

Source: Field Data (2026)

Operation of CNC and PLC-based machinery was identified as the most critical gap, cited by 78.6% of employer respondents. Industrial safety protocol compliance ranked second, cited by 65.4% of employers across the three regions. Fault diagnosis in automated systems (58.3%) and electrical drawing interpretation (52.7%) ranked third and fourth, respectively. The top six identified gaps included energy management systems (47.1%) and renewable energy installation knowledge (41.8%).

Technology Transfer Instances Reported by Eastern Region Firms

Eastern region engineering firms were asked to report the frequency of successful technology transfer instances in the past 12 months. Table 5 presents the frequency distribution of technology transfer instances which 48 Eastern region employer respondents reported.

Table 5. Frequency of Successful Technology Transfer Instances Reported by Eastern Region Firms

Technology Transfer Instances (Past 12 months)	**Frequency**	**Percentage (%)**
Zero instances	25	52.1
1 – 3 instances	15	31.3
4 or more instances	8	16.7
Total	**48**	**100.0**

Source: Field Data (2026)

Over half of Eastern region firms (52.1%) reported zero successful technology transfer instances from TVET graduates in the past year. A further 31.3% reported between one and three successful technology transfer instances within their establishments. Only 16.7% of Eastern firms reported four or more successful instances of technology transfer from TVET graduates. These figures represent a severe deficit in applied knowledge transfer in the Eastern industrial zone.

Graduate Transition Rates across Regions

The transition rates for the study were calculated by measuring the percentage of graduates who found jobs as electrical engineers within 18 months after their graduation. Table 6 presents the transition rates of TVET graduates into formal engineering roles across the three regions.

Table 6. Graduate Transition Rates into Formal Engineering Employment by Region

Region	**Total Graduates**	**Transitioned to Eng. Role**	**Transition Rate (%)**
Greater Accra	101	42	41.6
Ashanti	100	38	37.9
Eastern	99	22	22.4
Overall	300	102	34.0

Source: Field Data (2026)

Greater Accra recorded the highest transition rate at 41.6%, followed by Ashanti at 37.9% and Eastern at 22.4%. The three regions together had a transition rate of 34.0%, which equated to 102 graduates from a sample of 300.

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Among graduates not in formal engineering roles, 43% reported working in informal electrical services or self-employment. A further 24% of non-transitioned graduates reported being underemployed in non-technical service sector positions.

Independent Samples T-Test Results for Regional Comparisons

The study used Independent samples T-tests to assess whether regional differences in curriculum scores and transition rates reached a level of statistical significance. The complete T-test results for all regional comparisons conducted in this study appear in Table 7.

Table 7. Independent Samples T-Test Results for Regional Comparisons

Comparison	Variable	df	t-value	p-value	Mean Diff.
Accra vs Ashanti	Curriculum Alignment	199	1.12	0.264	0.13
Accra vs Eastern	Curriculum Alignment	198	3.47	0.001**	0.30
Ashanti vs Eastern	Curriculum Alignment	197	2.81	0.005**	0.26
Accra vs Eastern	Transition Rate	197	4.27	0.000**	19.2%
Ashanti vs Eastern	Transition Rate	196	3.09	0.002**	15.5%

Source: Field Data (2026) ** $p < 0.01$

The results showed no significant difference between Greater Accra and Ashanti regarding curriculum alignment ($t = 1.12$, $p = 0.264$). The Accra to Eastern comparison showed high significance because of the results ($t = 3.47$, $p = 0.001$), while the Ashanti to Eastern comparison showed high significance because of the results ($t = 2.81$, $p = 0.005$). The transition rates showed statistical significance for both Accra to Eastern ($t = 4.27$, $p < 0.001$) and Ashanti to Eastern ($t = 3.09$, $p = 0.002$) comparisons. The results demonstrate that the Eastern region performs both variables at a level which shows a significant difference from the two other regions.

DISCUSSION OF FINDINGS

The three regions display below-average curriculum relevance scores, which prove that the partnerships between academia and industry are faced with basic operational issues. This was predicted in the Triple Helix model by Addy et al. (2025) as the weak academia-industry linkages turned out to be the major inhibitor of knowledge transfer. The same argument is made by Etzkowitz (2003), who notes that TVET systems fail when the government abandons its role of coordinating. These theoretical arguments are substantiated by current data using empirical testing in three regions of Ghana. Similarly, Ntetha and Taole (2025) found curriculum stagnation to be a challenge faced by the sector in West African electrical TVET programs. Curriculum inertia in the policy framework in Ghana is specifically related to the fact that there is no statutory industry consultation in the policy framework in Ghana.

The government node of the Triple Helix does not show active involvement in its responsibility to control educational programs. Lamptey (2022) condemned the Ministry of Education that assigned review of the curriculum without offering mandatory frameworks of industry consultation. According to Ranga and Etzkowitz (2013), the Triple Helix framework shows that emerging economies have issues in the performance of nodes in the government. The findings of this study are the results of the research that contains concrete evidence and expands the original criticism to three different economic regions. Ekuma (2019) suggests that the currency governance needs to be subject to statutory reform as the least intervention necessary to get the government node running.

Moreover, on the industrial skill gaps, the research findings that were obtained in the Accra and Kumasi research confirm the assertions made by Owusu-Ansah (2024) about industrial skill gaps in Ghanaian Technical and Vocational Education and Training programs. The study verified that less than 40% of Technical and Vocational Education and Training graduates would fulfil employer requirements according to Owusu-Ansah's (2024)

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prediction. The 30% adequacy rating by employers in both Accra and Kumasi is very close to the ceiling projected by Owusu-Ansah. Chiamogu and Chiamogu (2025) found that employers in Kumasi manufacturing facilities expressed strong discontent about the skills possessed by Technical and Vocational Education and Training graduates. The employer group from Kumasi evaluated their work satisfaction at a level that exceeded the predictions established by Owusu-Ansah's regional models. King and Palmer (2010) explain that regions with multiple industries create diverse training opportunities, which lead to different skill development pathways.

Moreover, the finding that industrial areas show higher technology transfer rates because of their industrial strength serves as the first major evidence of this research study. Ntetha and Taole (2025) theorised that institutional proximity to industrial clusters would positively correlate with graduate employability. The current data support this hypothesis because Greater Accra showed both the highest curriculum ratings and the highest transition rates. Lamptey (2022) found that Accra-based institutions acquire benefits from industry partnerships which they maintain without official permission. The research results show that TVET outcomes across different regions in Ghana display the same pattern as spatial development disparities which exist throughout the country. Aggarwal and Mani (2025) discovered that urban industrial concentration in South Asian economies led to increased TVET transition rates, which showed similar results throughout the region.

The Eastern region shows a need for special analytical work because it has achieved lower results in both of its performance measures. Addy et al. (2025) found that the Eastern region experienced vocational training challenges because of its divided industrial system and its small number of multinational companies. The World Bank (2014) reports that regions which lack major industrial centres generate TVET graduates who have restricted access to real-world training. The Eastern region needs infrastructure development, according to Owusu-Ansah (2024), because it serves as the essential foundation for enhancing vocational education in the area. The researchers Mugabirwe et al. (2025) present their case that the government needs to match industry investment because this funding partnership will drive vocational education development in remote industrial areas.

The research shows that Ghanaian TVET graduates, after finishing their studies, do not follow the pathways which previous studies established. Addy et al. (2025) projected that more than 50% of electrical TVET graduates who did not complete their studies would work in informal self-employment. The research discovered that only 43% of graduates who did not complete their studies found informal employment in electrical self-employment. The study found that 24% of participants who entered non-technical service sector positions had abandoned their field of work. Oketch (2007) did not anticipate this degree of occupational deviation from the electrical engineering discipline among non-transitioned graduates. Lauglo (2005) suggest that such labour market displacement reflects a failure of both institutional and governmental reintegration support systems.

CONCLUSION AND RECOMMENDATIONS

The study evaluated how well electrical TVET programs in Ghana's three main industrial areas transfer technology. The evidence shows that TVET curricula do not match the technical needs of modern Ghanaian factories. Eastern region students achieved the lowest curriculum relevance scores, which all three regions tested proved to be below the midpoint of the Likert scale. The Eastern region recorded employment transition rates of 22.4% while Greater Accra reached 41.6%. The Triple Helix Model developed by Etzkowitz and Leydesdorff (1998) worked effectively to explain the three study dimensions. The findings establish weak academia-industry-government interaction as the primary cause of technology transfer failure in Ghana's TVET sector.

Industry-Led Curriculum Development. Industry-Led Curriculum Development. The Ministry of Education needs to create a requirement that all electrical TVET programs must conduct curriculum assessments every two years. The review process requires engineering firms to participate in structured consultations throughout all three regions.

Establishment of Regional Industry-TVET Hubs. Establishment of Regional Industry-TVET Hubs. Electrical engineering students need better support through the establishment of Regional Industry-TVET Hubs, which will help them make successful transitions into their careers. The Hub operates as a common resource that all

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TVET institutions and manufacturing companies within the same economic zone can access. The Greater Accra region should be the first to be equipped with Pilot Hubs before extending to the Ashanti and Eastern regions.

Mandatory Apprenticeship Models. The Ashanti and Eastern technical universities should also introduce a mandatory apprenticeship course that will help the students to be linked with the local manufacturing companies. The establishment of legal frameworks which define apprenticeship standards and protect graduates should be integrated into TVET legislation.

The findings of the study are limited by its cross-sectional nature since the study is limited to measuring a single moment, and not showing which factor causes which outcome. Weyant (2022) observes that the temporal bias is likely to occur in cross-sectional designs in fast-paced industrial settings. Graduate self-reported data is subject to social desirability bias, which affects their employment outcomes, especially. The research was based in three regions, and the results of the research might not be generalisable to the northern or coastal Ghanaian TVET programs. The research did not examine the transition rates by gender, which conceals the most important issues of equity that influence the outcomes of TVET.

Further studies ought to examine how digital twins can support the transfer of technology in Ghanaian vocational training institutions. Future studies need to conduct qualitative follow-up studies which explore how graduates experience the industrial labour market in Ghana.

REFERENCES

1. Addy, E., Adabor, E. S., & Badu, Y. A. (2025). Promoting sustainable innovations in technical universities: Critical success factors of the triple helix model. Industry and Higher Education, 39(4), 453-471. https://doi.org/10.1177/09504222251336297
2. Agarwal, N., & Mani, S. (2025). New evidence on vocational and apprenticeship training programs in developing countries. In Handbook of experimental development economics (pp. 281-307). Edward Elgar Publishing. https://doi.org/10.4337/9781800885370.00020
3. Akyeampong, K. (2009). Revisiting free compulsory universal basic education (FCUBE) in Ghana. Comparative Education, 45(2), 175-195. https://doi.org/10.1080/03050060902920534
4. Amedorme, S. K., & Fiagbe, Y. A. (2013). Challenges facing technical and vocational education in Ghana. Cell, 233, 244833980.
5. Chiamogu, A. P., & Chiamogu, U. P. (2025). Bridging Skills Mismatch in Nigeria's TVET System: Integrating Industry 4.0 Competencies for Entrepreneurial Readiness. Journal of Science Innovation and Technology Research. https://orcid.org/0000-0002-7128-0033
6. Ekuma, K. (2019). Postcolonialism and national HRD: understanding contemporary challenges to skills development in sub-Saharan Africa. Human Resource Development International, 22(4), 321-342. https://doi.org/10.1080/13678868.2019.1612651
7. Etzkowitz, H. (2003). Innovation in innovation: The triple helix of university-industry-government relations. Social Science Information, 42(3), 293-337. https://doi.org/10.1177/05390184030423002
8. Etzkowitz, H., & Leydesdorff, L. (1998). A triple helix of university—Industry—Government relations: Introduction. Industry and Higher Education, 12(4), 197-201.
9. Khosla, I. (2021). Book review: Social research methods: Qualitative and quantitative approaches. https://doi.org/10.3389/fpsyg.2021.696828
10. King, K., & Palmer, R. (2010). Planning for technical and vocational skills development.
11. Lamptey, P. (2022). Ghana Beyond Aid: Reimagining the Role of Higher Educational Institutions in Ghana (Doctoral dissertation, Ashesi University).
12. Lauglo, J. (2005). Vocationalised secondary education revisited. In Vocationalisation of secondary education revisited (pp. 3-49). Dordrecht: Springer Netherlands. https://doi.org/10.1007/1-4020-3034-7_1
13. Mugabirwe, O., Muhumuza, B., & Mugabe, R. (2025). Rethinking Vocational Education and Training: A Systematic Review of Creativity, Innovation, and Skills Development in Sub-Saharan Africa. JMPI: Jurnal Manajemen, Pendidikan dan Pemikiran Islam, 3(2), 272-299. https://doi.org/10.71305/jmpi.v3i2.601

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue VIII, August 2026

14. Ntetha, Z., & Taole, M. J. (2025). Factors Influencing Workforce Development of TVET Graduates: A Case Study of Electrical Engineering Students in a TVET College in South Africa. Journal of Technical Education and Training, 17(2), 245-256. https://publisher.uthm.edu.my/ojs/index.php/JTET/article/view/13973
15. Oketch, M. O. (2007). To vocationalise or not to vocationalise? Perspectives on current trends and issues in technical and vocational education and training (TVET) in Africa. International Journal of Educational Development, 27(2), 220-234. https://doi.org/10.1016/j.ijedudev.2006.07.004
16. Owusu-Agyeman, Y., Brenya, B., Kwapong, O. A. T. F., & Abrefa-Gyan, T. (2025). Teacher perceptions about the reputation of technical and vocational education and training in Ghana. Education+ Training, 67(3), 361-388. https://doi.org/10.1108/ET-10-2023-0446
17. Owusu-Ansah, K. K. (2024). Sustainable development: Implications for urban employment in emerging global cities, a case study of Accra, Ghana. University of Wyoming.
18. Ranga, M., & Etzkowitz, H. (2013). Triple Helix systems: an analytical framework for innovation policy and practice in the Knowledge Society. Industry and higher education, 27(4), 237-262. https://doi.org/10.5367/ihe.2013.0165
19. UNESCO. (2015). Unleashing the potential: Transforming technical and vocational education and training. UNESCO Publishing.
20. Weyant, E. (2022). Research design: Qualitative, quantitative, and mixed methods approaches: by John W. Creswell and J. David Creswell, Los Angeles, CA: SAGE, 2018, $38.34, 304pp. ISBN: 978-1506386706. https://doi.org/10.1080/15424065.2022.2046231
21. World Bank. (2014). Skills for the labour market in Indonesia: Trends in demand, gaps, and supply. World Bank Group.
22. Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). Harper and Row.