

The Contribution of TVET to Cambodia's Economy. Case Study: National Polytechnic Institute of Cambodia (NPIC)

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Abstract

Recognizing the critical role a well-trained workforce plays in socioeconomic development, the Royal Government of Cambodia (RGC) introduced the Pentagonal Strategy Phase 1 during the 7th legislature of the National Assembly. This strategy emphasizes human capital development as its foremost priority, with “Technical Skills Training” identified as a key component. The goal is to transform Cambodia's workforce from predominantly labor-intensive to skill-intensive, thereby supporting the nation's vision of achieving a high-middle-income country by 2030 and becoming a high-income nation by 2050. To address the skills shortages that impede economic progress, the National Polytechnic Institute of Cambodia (NPIC) is actively contributing to the development of Cambodia's workforce. Additionally, NPIC has partnered with both local and international institutions, including the Tianjin Sino-German University of Applied Sciences (TSGUAS). Together, they have signed a Memorandum of Understanding (MoU) to establish the Cambodia-Luban Workshop Project, also known as the “Lancang-Mekong Vocational Education Training Center,” to tackle these challenges. Therefore, the main aim of this paper is to study the skills shortage and its effects, as well as the contribution of skills development at both the industrial and national levels. This will be achieved using the Ordinary Least-Squares (OLS) regression, which allows for a comprehensive analysis of the economic impacts of skills development initiatives.

Keywords

TVET Contributed to Cambodia's Microeconomics and OLS Regression

1. Introduction

Cambodia has achieved an impressive annual growth rate of about 7 percent during the past two decades. Despite this economic growth, the Royal Government of Cambodia (RGC) needs to further boost its socio-economic development if Cambodia is to catch up with its regional peers and meet government goals of becoming an upper-middle-income country by 2030, and a high-income country by 2050 (World Bank, 2018a). To fulfill this ambition, the Royal Government of Cambodia (RGC) in the 7th legislation of the National Assembly introduced “Learn to complete, learn to know, and have a job” which aligns with the first phase of the pentagonal strategy, which prioritizes human resources. It focuses on building and developing high-quality human capital with clear professional skills, creativity, and high competitiveness, aiming to achieve the goal of “at least one skill per citizen for life” (RGC, 2023). Cambodia’s development partners have also made strong commitments to enhance skills development across Cambodia. Instance, the Lancang-Mekong Vocational Education Training Center implemented the “Luban Workshop Project” with the Ministry of Labor and Vocational Training (MoLVT) to train the certification level to meet the needs of industries.

Although, Cambodia still faces many challenges in skills development that remain critical to its economic development (Sothy et al., 2015; Madhur, 2014). Previous studies (Bruni, Luch, & Kuoch, 2013; EMC, 2014; Kuoch, 2015; HRINC, 2010) indicated that skilled labour shortages and skills gaps are acute in the Cambodian labour market due to education and training systems that are not responsive to labour market demand. Improving the match between the skills demand and skills supply will need further effort and resources, such as improving the relevance and quality of training, as well as expanding the skills training provisions across the country. The contribution of technical vocational education and training (TVET) to meeting the skills needs and growth of the manufacturing industry and wider economy, as well as its effects on income distribution and social welfare, is little studied in Cambodia. Therefore, the main aim of this paper is to study the impact of TVET on the microeconomy, using the National Polytechnic Institute of Cambodia as a case study.

1.1. Brief TVET Cambodia and NPIC

The Cambodian education system is divided into three streams: general education, higher education, and Technical and Vocational Education and Training (TVET). General education includes pre-school, primary school (grades 1 - 6), lower-secondary school (grades 7 - 9), and upper-secondary school (grades 10 - 12) (World Bank, 2018b). After completing upper-secondary school, students can pursue higher education, which starts with a foundation year, followed by an associate degree (two years), a bachelor’s degree (an additional two years), a master’s degree (another two years), and a doctoral degree (three years) (World Bank, 2018c). The third stream, TVET, provides specialized technical and vocational training and refers to education and training that focuses mainly on practical skills

and the ability to perform tasks in a particular industry sector (RGC, 2017; CDRI, 2019). **Figure 1** demonstrates the Cambodian education system.

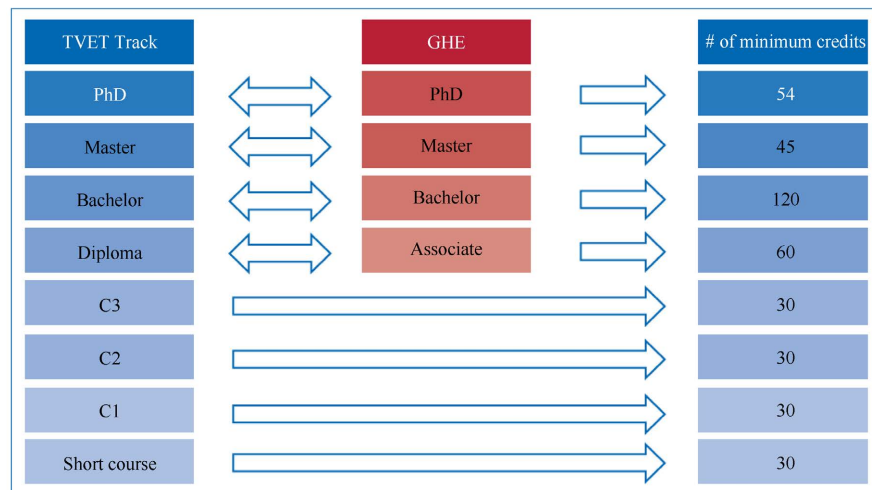


Figure 1. Cambodian education system. Source: Retrieved CDRI (2019).

The Ministry of Education, Youth and Sport (MoEYS) oversees general and higher education, while the Directorate General of TVET (DGTNET) under the Ministry of Labour and Vocational Training (MoLVT) manages the national TVET system. Students can enroll in formal TVET programs after completing grade 9, which marks the end of basic education. The TVET stream is flexible, allowing students to work and continue their training simultaneously after completing each level (UNESCO, 2020). Graduates with TVET diplomas and certificates can take exams or pursue further studies in university general education streams. The TVET system includes both formal and non-formal learning and development programs, covering four main levels:

- **Short Courses:** Non-formal courses lasting from a few weeks to less than a year.
- **Certificate Levels:** Divided into three levels—Certificate 1 (one-year program for semi-skilled workers), Certificate 2 (two-year program for skilled workers), and Certificate 3 (three-year program for highly skilled workers).
- **Diploma:** Post-grade 12 entry, requiring two years of study in technical institutions and polytechnics, leading to a diploma degree (technician).
- **Engineering Degree:** Post-grade 12 plus four years of study for an engineering degree, or a diploma plus two additional years for the same degree.

National Polytechnic Institute of Cambodia (NPIC) is an autonomous public administration institute with the role of providing technical education and training from short courses to post-graduate technical degree. As an alternative stream for people and especially youth to acquire skills, NPIC is indispensably complemented to education system in Cambodia. NPIC strives to become a technical institute taking lead in vocational and technical education in Cambodia aiming at equipping required skills, knowledge, technology, and sciences relevant to Cambodia's context for workers, apprentices, technicians, and applied engineers. We

embrace “We Must Be the First” as the motto, “learn to apply, learn to create, learn to innovate and life-long-learning” as the training principles. It offers flexible training schedules and patterns which provide more options for learners, especially youth, to acquire skills for career growth.

- Full time—weekday (8 am - 4 pm): programs are designed to target high school graduates (grade 9 & grade 12) and youths who wish to pursue technical training.
- Part time—weekday (5:30 pm - 8:30 pm) & weekend (8 am - 5 pm): programs are designed to tackle the needs of employed students and employed people who want to reskill, upskill or gain further technical skills for career development.
- The customized training—(time is based on discussion): programs specifically designed to meet the needs of the company for staff’s capacity upgrading.

In 2005, NPIC started recruiting NPIC’s fresh graduates who are capable and passionate about education and training. To ensure they can deliver training activities, NPIC prepared internal short-cut training for the fresh graduates to become trainers and teachers. Also, NPIC started maintaining training quality emphasizing on trainers’ capacity development through partnerships with overseas institutes and seeking scholarship opportunities for trainers, teachers, and staff to gain master’s and PhD degrees, while continuing to keep training programs, technology and innovation development for the competitive changes (Sokheng, 2024) (Figure 2).



Figure 2. Competitive change processes. Source: Retrieved from NPIC’s GEMSET application report.

In NPIC, students are not the objectives for business purposes; instead, they are the offshoots of the new generation for getting trained and developed to become the driven workforce social and economic development of the country. In the academic year 2023-2024, the total number of NPIC students reached 7707; with the freshmen roughly around 2000 students which accounts for only just 1.5% of the total high school graduates of 137,412 persons. This small proportion of absorption is due to the limited infrastructure, classes, workshops, labs, and trainers that NPIC can offer. However, looking back at the past performance, it indicates remarkable development of NPIC based on the increasing number of students from the academic year 2005-2006 to 2023-2024 (Figure 3).

The success of NPIC training programs is measured by the number of successful graduates, accounting for retention from enrollment to obtaining a graduate certificate. NPIC has consistently achieved remarkable success from 2017 to 2023. As illustrated in Figure 4, NPIC produced an average of over 1000 graduates annually from 2017 to 2022, with the highest number being 1697 graduates in 2023.

From the academic year 2006-2007 to 2022-2023, NPIC produced a total of 11,158 graduates, with 14% being female graduates (as shown in **Figure 4**). The proportions of graduates at the engineering and diploma levels are 54% and 35%, respectively, which have been successfully integrated into the labor market.

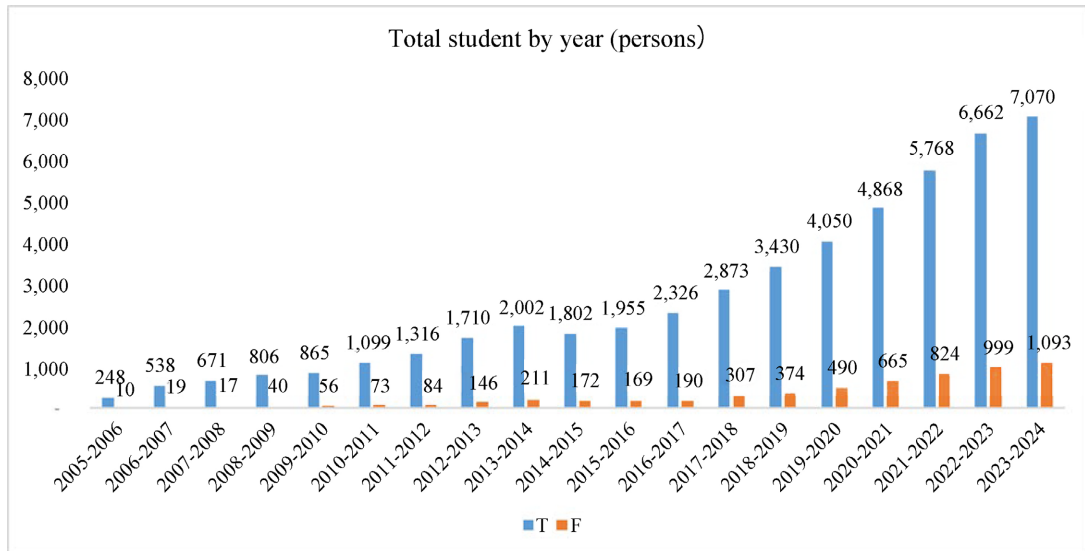


Figure 3. Number of students since 2005-2024. Source: Retrieved from NPIC’s GEMSET application report.

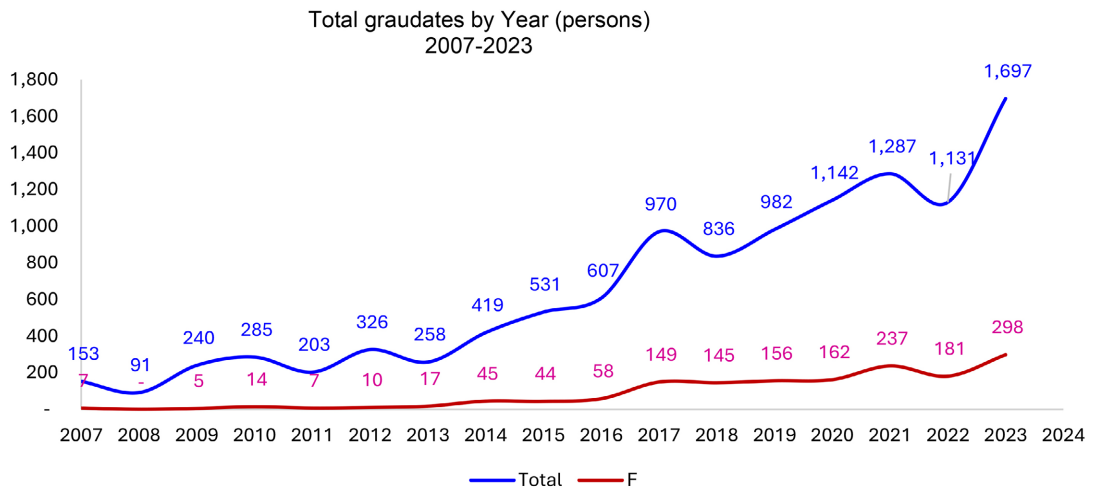


Figure 4. Total graduates by year (person) from 2007-2023. Source: Annual report of NPIC.

To evaluate the prestige of NPIC education, we annually conduct basic trace surveys (3-month, 6-month, and 9-month after graduation) on fresh graduates to understand their employability. Based on the survey, approximately 83% of the reachable 70% of graduates were able to secure jobs. This is compelling evidence of the high market applicability of an NPIC education. The final success of NPIC training programs is measured by the success rate, which accounts for student retention from enrollment to obtaining NPIC certifications, as well as successful employment. NPIC has continuously achieved a high student success rate between

2019 and 2023, with 89% in 2021 and 80% in 2023 of students graduating from NPIC securing jobs (**Figure 5**). The remaining percentage includes students who have started their own businesses and/or are pursuing higher education.

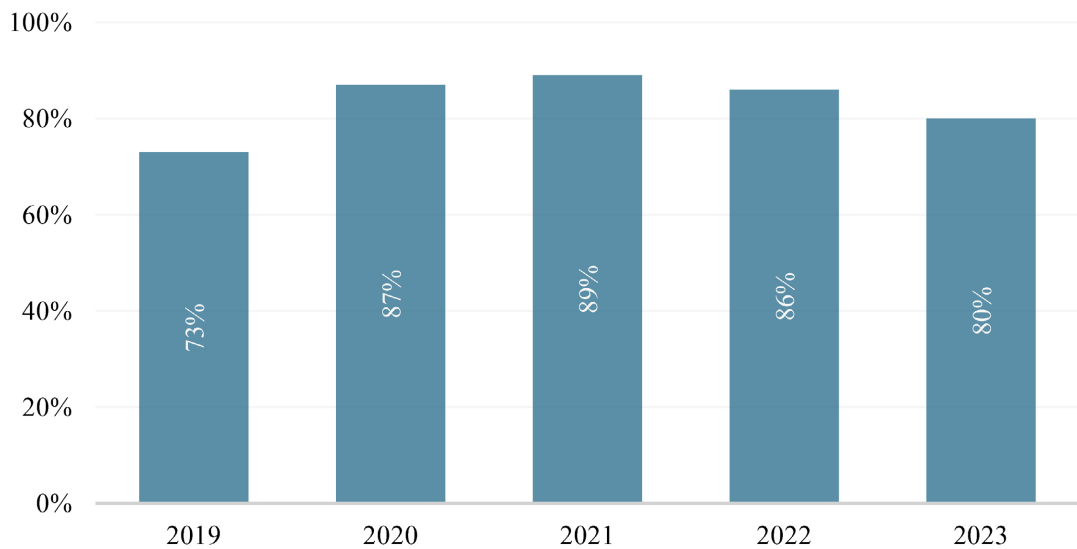


Figure 5. Student success rate employed by industry/company. Source: Annual Relation Cooperation Office (RCO) of NPIC Survey.

1.2. Brief LMTC

The project of the Lancang-Mekong Vocational Education Training Center (also known as the Cambodia-Luban Workshop) was proposed by Premier Li Qiang at the first Lancang-Mekong Cooperation Leaders' meeting in March 2016. In November 2016, both the National Polytechnic Institute of Cambodia (NPIC) and Tianjin Sino-German University of Applied Science signed a Memorandum of Understanding (MoU), assuming the project's construction responsibilities, as commissioned by both sides.

On October 28, 2018, H. E. Ith Sam Heng, Minister of Labour Vocational Education Training, H.E. Li Hongzhong, Secretary of the CPC Tianjin Municipal Committee, attended the inauguration ceremony. The majors offered in the first phase of the Cambodia-Luban Workshop included Mechatronics Technology, Electrical Technology, and Communication Technology, and three practical training centers in Machining Technology, Mechatronics Technology, Electrical Technology, and Communication Technology were built, with a total of 18 training workshops covering an area of 6814 square meters. Moreover, in 2023 the project progressed to meet second and third phases for installation 5 more workshops with the new modern training equipment the center included practical teaching and vocational training needs Tour Guide Practice and Managing Tour Group for Tour Guides and Building Power Supply and Distribution Monitoring System Training and Building Intelligent Engineering Technology Training. The construction goal of the Cambodia-Luban Workshop was to establish vocational education, vocational

training, scientific research, and innovation and entrepreneurship, focusing on serving Cambodia, the five Lancang-Mekong countries, and then radiating to the ten ASEAN countries. In the academic year 2023-2024, there were 149 students enrolled in the center, the total number of students enrolled reached 1118 persons from 2018-2019 to 2023-2024 (**Figure 6**).

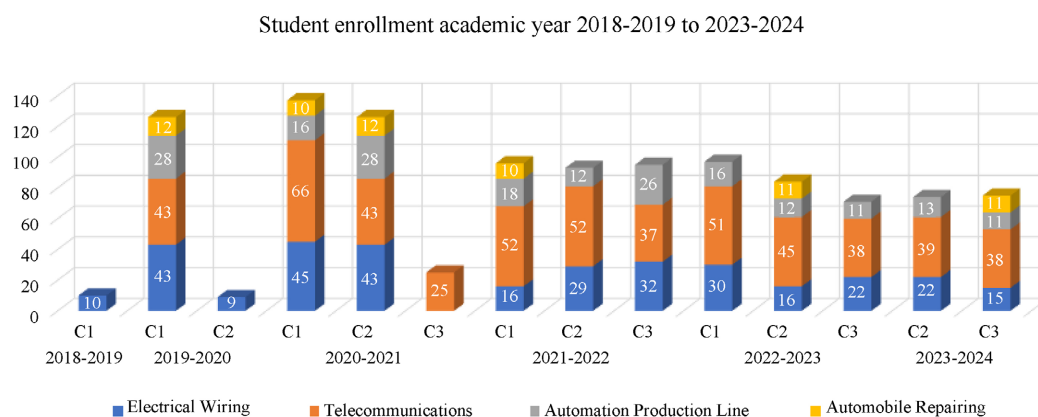


Figure 6. Certificate students year 2018-2024. Source: LMTA Annual Report.

2. Research Methods

2.1. Data Collection

For data collection, we selected a representative sample of graduates from NPIC's TVET program. We focused on a single academic year (2022-2023) to ensure the survey was feasible and manageable. Due to time constraints, we conducted the online survey using Google Forms and phone calls, and requested the alumni list from the Relation and Cooperation Office of NPIC to contact them. Participants from short courses were excluded due to their brief duration (minimum one week). Therefore, only those with certifications, diplomas, and engineering degrees were included in the sampling frame. **Table 1** shows the sample size of the survey for the academic year (2022-2023) across different levels.

Table 1. Survey sample size.

| Subjects | Number of Graduate Students (2022-2023) | Sample Size (Yamane formula) |
|----------------------------|---|------------------------------|
| Certificates | 145 | 56 |
| Electricity | 357 | 137 |
| Civil & Architecture | 219 | 84 |
| Automobile Mechanics | 204 | 78 |
| General Mechanics | 89 | 34 |
| Electronic | 44 | 17 |
| Information and Technology | 67 | 28 |
| Tourism & Hospitality | 34 | 13 |
| Total | 1159 | 447 |

2.2. Econometric Models

The study employed an Ordinary Least-Squares (OLS) regression, utilizing STATA software, to analyze the TVET sector in the NPIC case study and its impact on Cambodia's microeconomics. The OLS model helps understand the relationship between a dependent variable (such as economic growth or employment rates) and one or more independent variables (such as TVET enrollment rates, graduation rates, or investment in TVET programs). The general form of the OLS regression equation is:

$$Y = \beta_0 + \beta_1 a_1 + \beta_2 a_2 + \dots + \beta_i a_i + \varepsilon \quad (1)$$

where:

- Y : is the dependent variable.
- β_0 : is constant.
- $\beta_1, \beta_2, \dots, \beta_i$: are the coefficients for the independent variables.
- a_1, a_2, \dots, a_i : are the independent variables.
- ε : is the error term.

Equation (1) is always treated as a linear relationship by making a logarithm transformation, which outcome:

$$\ln Y = \beta_0 + \beta_1 \ln a_1 + \beta_2 \ln a_2 + \dots + \beta_i \ln a_i + \varepsilon \quad (2)$$

According to Equation (2) with independent a_1, a_2, \dots, a_i and decoding Equation (2) based on the study, we have as follows:

$$\ln Y = \beta_0 + \beta_1 \ln ag + \beta_2 \ln ge + \beta_3 \ln sk + \beta_4 \ln le + \beta_5 \ln fe + \beta_6 \ln he + \beta_7 \ln jo + \beta_8 \ln kjo + \beta_9 \ln wa + \beta_{10} \ln pe + \varepsilon \quad (3)$$

where:

- $\ln ag$: logarithm of age of attending school's respondent.
- $\ln ge$: logarithm of gender's respondent.
- $\ln sk$: logarithm of skills' respondent (Including Electricity, Civil Engineering & Architecture, Automobile mechanics, General Mechanics, Electronics, and IT).
- $\ln le$: logarithm of low-educated respondents (Certificate level).
- $\ln fe$: logarithm of fairly educated respondents (diploma or associate degrees).
- $\ln he$: logarithm of highly educated respondents (engineering degrees).
- $\ln jo$: logarithm of getting a job or not getting a job's respondent.
- $\ln kjo$: logarithm of kinds of job's respondent.
- $\ln wa$: logarithm of wage respondent.
- $\ln pe$: logarithm of personal expenses' respondent.
- $\ln Y$: logarithm of income respondents.
- The coefficient $\beta_1, \beta_2, \beta_3, \dots, \beta_i$ are the income elasticity concerning input and i . The sum of elasticity $\beta_1 + \beta_2 + \beta_3 + \dots + \beta_i$, provides the returns to scale of the farms in question. It means if: $\beta_1 + \beta_2 + \beta_3 + \dots + \beta_i = 1$, the income operates under constant returns to scale.
- $\beta_1 + \beta_2 + \beta_3 + \dots + \beta_i > 1$, the income operates under increasing returns to scale.
- $\beta_1 + \beta_2 + \beta_3 + \dots + \beta_i < 1$, the income operates under decreasing returns to scale.

3. Results and Discussion

Refer to **Table 2** below, which shows that most independent variables significantly impact the outcome. However, the variables “sex of the respondent” and “type of occupation” do not affect the income elasticity of demand. The OLS regression was used to estimate the inputs affecting microeconomics in a TVET case study conducted at NPIC. The results indicate that a 1% increase in the age of respondents would increase personal income by 0.588%. Similarly, a 1% increase in training skills (reskilling and upskilling) in areas such as electricity, automobile mechanics, civil & architecture, general mechanics, electronics, and IT would increase income by approximately 0.937%. A 1% increase in low-educated training (certificate levels C1, C2, and C3) would boost the outcome by about 0.244%. An increase of 1% in fairly educated training (diplomas or associate degrees) would raise personal income by 0.334%. If highly educated training (engineering or bachelor’s degrees) increases by 1%, the outcome would rise by around 0.624%. A 1% increase in wage labor would increase income by approximately 0.115%. Conversely, a 1% increase in personal expenses would decrease the outcome by around 0.095%.

Table 2. The estimated parameters of OLS regression for TVET to impact personal income.

| Variable | Coefficient | Std. Err. | T-Value | P-Value | [95% Conf. Interval] |
|-------------------|---------------------|-----------|---------|----------|----------------------|
| <i>Constansts</i> | β_0 8.243 | 2.058 | 3.520 | 0.000*** | 3.162 12.315 |
| <i>lnag</i> | β_1 0.588 | 0.055 | 1.700 | 0.002*** | 0.196 0.021 |
| <i>lnge</i> | β_2 0.084 | 0.094 | 3.120 | 0.403 | 0.098 0.480 |
| <i>lnsk</i> | β_3 0.937 | 0.080 | 0.460 | 0.000*** | 0.195 0.123 |
| <i>lnle</i> | β_4 0.244 | 0.119 | 2.080 | 0.043** | 0.008 0.470 |
| <i>lnfe</i> | β_5 0.334 | 0.109 | 0.310 | 0.007*** | 0.250 0.182 |
| <i>lnhe</i> | β_6 0.624 | 0.054 | 0.970 | 0.000*** | 0.054 0.162 |
| <i>lnjo</i> | β_7 0.197 | 0.077 | 0.350 | 0.028** | 0.180 0.127 |
| <i>lnkj</i> | β_8 0.093 | 0.102 | 0.910 | 0.366 | 0.110 0.295 |
| <i>lnwa</i> | β_9 0.115 | 0.077 | 1.490 | 0.031** | 0.038 0.268 |
| <i>lnpe</i> | β_{10} -0.095 | -0.055 | -0.100 | 0.072* | -0.104 -0.124 |
| Number of obs | = | 447 | | | |
| Prob > F | = | 0.0033 | | | |
| R-squared | = | 0.2223 | | | |
| Adj R-squared | = | 0.1454 | | | |
| Root MSE | = | 0.2726 | | | |

Note: *** Indicated to significant at 1%, ** at 5%, and * at 10%. Source: Author.

One of the key coefficients, the income elasticity of demand, is highest for training skills, followed by higher education and the trainer’s age. Research by the Cambodia Development Research Institute (CDRI, 2019) on the economic returns of investing in education and TVET, along with Seyhah and Naron’s (2020) study

on the impact of vocational skills development on Cambodia's economy, and Vathana Roth's (2019) research on job prospects for youth, low-skilled, and women workers in the Greater Mekong Subregion, demonstrated that TVET graduates tend to secure higher wages and immediate employment post-graduation. However, graduates with certificate levels (C1, C2, and C3) perform relatively poorly in all measured labor market outcomes and earn lower wages compared to those with diplomas and engineering degrees. Despite this, certificate levels still play a significant role in the labor market, contributing to the shift from labor-intensive to skill-intensive sectors in Cambodia. Additionally, TVET programs serve as a bridge for students who drop out of primary school, allowing them to pursue and select skills in TVET programs and eventually continue their studies toward diplomas or engineering degrees.

4. Conclusion and Recommendations

Given the above findings and explanations, we conclude and recommend the following:

The Royal Government of Cambodia, particularly the Ministry of Labour and Vocational Training (MoLVT) and the National Polytechnic Institute of Cambodia (NPIC) has made significant efforts to narrow the skills gaps and mismatches. However, TVET still has a long way to go before Cambodia can fully harness the potential of its talented youth. TVET must focus on attracting more secondary school students and dropouts to pursue certificates, diplomas, and engineering degrees. This is a crucial first step in TVET reform for a developing country like Cambodia (Smith-Comyn, 2011). Secondly, there is a need to promote quality TVET in hard and soft skills to meet the evolving labor market needs. This requires strengthening and upgrading the knowledge and skills of technical teachers and trainers in new technology and science. Additionally, technical schools and institutes must have adequate training facilities and equipment. Developing competency-based curricula that respond to new technological trends, increasing internet connectivity, collaborating with relevant employers and training providers, and offering in-service training are essential. Thirdly, the private sector plays a vital role in addressing many of the important and challenging tasks, given the complexity and limited capacity and resources of the government (Roosdiono, 2012; Sothy et al., 2015). The needs and concerns of the private sector can be addressed through partnerships between the private sector, TVET providers, and policy-making institutions. These partnerships may include curriculum design, training, apprenticeships, internships, and significant investment and funding by the private sector. The collaboration between the private sector and Technical and Vocational Education and Training (TVET) institutions is a key focus of the government's strategy to enhance workforce skills. The Royal Government of Cambodia has emphasized public-private partnerships (PPP) in its national TVET Policy 2017-2025 and the Skills Development Roadmap 2023-2035. In summary, the shortage of skilled labor continues to be a major obstacle to the country's future economic growth. Despite this, the challenge for the government, MoLVT, and

private sector is to encourage more students to enter the TVET sector—a tough battle that is worth fighting.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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