

# Vocational Education and Training's Effect on Employment Opportunities in Northwestern Vietnam's Ethnic Minority Regions

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## Abstract

*This study examines how vocational education and training impact employment prospects for ethnic minority workers in the Northwest area of Vietnam, specifically looking at opportunities for paid employment and the shift from agriculture to other industries. Through logistic regression analysis, it was determined that vocational training greatly improves employment opportunities, with age and technical skills being key factors in securing a job. Individuals with vocational training experience enhanced job prospects compared to individuals lacking such training or holding advanced academic qualifications. The study emphasizes a significant shift of skilled workers from agriculture to other industries due to improved career prospects and higher earnings. The report also highlights fluctuations in employment likelihoods according to gender, geographic area, and sector throughout time. The study suggests that combining vocational training with local socio-economic development, focusing on vocational coaching, and establishing partnerships for training can greatly enhance job opportunities for ethnic minority workers in Vietnam. The government should create vocational training programs tailored to local socio-economic development needs and assist businesses in educating and hiring individuals from varied ethnic backgrounds to boost economic growth and decrease employment inequalities.*

**Keywords:** *Vocational Education and Training, Employment Opportunities, Ethnic Minority, Vietnam.*

## Introduction

Vietnam is a country that boasts a rich and diverse cultural heritage, comprised of 54 unique ethnic groups, each with its own customs, dialects, and way of life. The Kinh ethnic group accounts for the largest population segment, comprising 85.3% (General Statistics Office, 2020). Their communities are generally located in areas that have easy access to critical resources such as healthcare, education, and infrastructure. On the other hand, minority groups tend to live in less productive regions and mountainous areas, where they have limited access to these vital facilities. As a result, they often experience significantly lower living standards than the majority population, as noted in reports by Imai et al. (2011), Tran et al. (2015), and Nguyen et al. (2017).

The ethnic minority region in Vietnam is home to almost 12.3 million individuals, making up 14.27% of the country's total population. They reside primarily in the Northern midlands and mountain areas, the Northern Central area and Central coastal area, the Central Highlands, and the Mekong River Delta. The Northwestern region is a subdivision of the Northern midlands and mountain areas, consisting of six provinces: Lao Cai, Dien Bien, Lai Chau, Son La, Yen Bai, and Hoa Binh. It encompasses 15.3 percent of the country's total land area (General Statistics Office, 2020). The terrain is rough and highly divided, yet it is a critical area with plentiful natural resources essential for national security and defense. China and Laos border this area. Northwestern's population represents 4.9% of the country's population, with 74.6% being ethnic minorities. The region has significant ethnic variety, with 50 out of Vietnam's 53 total ethnic groups being present (Do et al., 2021).

Many ethnic minorities face significant challenges in their daily lives. As of 2020, over 27% of the ethnic minority population still lived in poverty or extreme poverty, which is more than five times higher than the national average. Unemployment and underemployment remain significant factors contributing to this issue (The Ministry of Labour, Invalids and Social Affairs, the Committee for Ethnic Minority Affairs, General Statistics Office, and United Nations Development Program in Viet Nam, and GREAT/DFAT, 2022). Simultaneously, obtaining productive employment is still a big challenge for workers from certain ethnic

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groups (Pham & Tran, 2021). In regions with ethnic minority populations, the labor force primarily works in agriculture. These individuals often have limited access to education and training, resulting in a lack of skills and low production levels (Do et al., 2020<sup>a</sup>; Nguyen et al., 2023).

Providing vocational training to workers in ethnic minority regions holds both economic and social significance. Such training directly impacts employment opportunities and income, enhancing human resources quality, boosting labor productivity, restructuring the industry and economy, and promoting the industrialization and modernization of agriculture (Do et al., 2020<sup>a</sup>, 2021). Vietnam has implemented several policies to support vocational training for workers in ethnic minority regions since the Doi Moi era. These policies have taken different forms of assistance and have yielded positive results, such as reducing the number of poor households and improving the material and spiritual well-being of the people (Do et al., 2020<sup>b</sup>). However, the policy's objective of providing paid employment opportunities for trained workers in ethnic minority areas has not been fully met.

This study utilizes the probit model to evaluate the influence of trained workers on obtaining paid job opportunities. The decision to focus on paid employment opportunities is based on two factors: (i) Vietnam's unemployment rate for the labor force is relatively low, at only 3%, indicating that almost everyone has a job (General Statistics Office, 2020); (ii) the study aims to ensure that workers can secure jobs, hence the selection of the dependent variable. Additionally, vocational training seeks to facilitate career transitions for workers, shifting them from agriculture to non-agricultural roles. Therefore, the study employs a model with a second dependent variable, the likelihood of working in agriculture. The results of this model will enable an assessment of the probability of vocationally trained workers exiting the agricultural sector. Ultimately, this research will offer insight into the situation in Vietnam, particularly for ethnic minority workers in the underdeveloped Northwest region, which relies heavily on agricultural activities.

## Literature Review

The impact of vocational training on workers' career outcomes is a major concern of researchers. Many studies have evaluated the impact of vocational education on unemployment risk and career allocation at the early career stage of workers. The results show that workers who are not involved in these systems TVET workers who enter the labor market spend more time looking for work and face more uncertainty than other workers who enter the vocational education system (Allmendinger, 1989; DeFreitas et al., 1991; Müller et al., 2002; Kalter & Kogan, 2006; Bol et al., 2019). Shavit & Müller (2000) and Ozer & Perc (2020) evaluated the safety net and the diversionary effect of vocational training at the early stages of an individual's career. The research indicates that vocational training offers a reliable safety net by reducing the likelihood of unemployment and increasing the probability of securing skilled employment compared to individuals with similar general education levels but without vocational training. Their research indicates that career transitions have a beneficial effect in nations with well-funded and broad vocational training like OECD countries, enabling workers to pursue higher-quality jobs. In countries with inadequate vocational training or a lack of emphasis on it, there is little influence on job options, leading to a higher chance of unemployment for workers.

Dieckhoff (2008) and Korber (2019) examined how vocational education affects labor market outcomes in Germany, Denmark, Switzerland, and the United Kingdom. Their studies found that workers with vocational training have better outcomes than those without vocational training or with higher education. They looked at three specific outcomes: wages, the likelihood of low-skilled jobs, and the likelihood of high-productivity jobs. Their findings show that vocational training positively impacts wages and the availability of high-productivity job opportunities. Do et al. (2023) further suggested that the proportion of decent jobs rises as the amount of technical qualification attainment associated with the ICT index increases.

Braun et al. (1997) analyzed the effect of beginning vocational training on the probability of unemployment and access to skilled occupations in France, Germany, the United Kingdom, and Hungary. They discover significant beneficial impacts for Germany but weaker effects for other nations. Additionally, numerous

studies suggest that vocational training increases individual mobility and has a considerable impact on employment and income opportunities (Rosenbaum & Kariya, 1989; Witte & Kalleberg, 1995; Ryan, 2001; Obadic & Broz, 2008; Bol et al., 2019).

Spence (1981), Mincer (1993, 1994), Winkelman (1996), Lázaro et al. (2000), Heath et al. (2008), Nez & Livanos (2010), Lavrinovicha et al. (2015), Azman et al. (2020), and Altindag et al. (2022) are just a few of the studies that demonstrate the close relationship between education levels and unemployment rates. Among the earliest theoretical models to explain the low unemployment rate among college graduates are those offered by Nickell (1973) and Arrow (1973). They demonstrate that education leads to the accumulation of highly productive human capital and that employers have an interest in preserving high levels of productivity; therefore, highly educated people are less likely to be disadvantaged. more business when personnel is reduced.

The relationship between education level and unemployment is an intriguing research topic in labor economics. Livanos (2009) investigates the impact of gender, education, and demographic factors on the likelihood of unemployment in Greece and draws the following conclusions: (i) Higher levels of education reduce the probability of unemployment; (ii) even after controlling for other factors, the probability of unemployment is higher for women than for men; (iii) demographic factors such as age and family size also play a significant role in determining the incidence of unemployment in Greece. The study argues that policies focusing on increasing education levels, reducing gender disparities, and addressing the needs of certain demographic groups could help reduce the jobless rate in Greece.

Núñez & Livanos (2010) undertook a statistical survey of the European labor force to evaluate the relationship between college graduation and unemployment. The authors assessed how schooling impacts short-term and long-term unemployment by employing the M-logit model and including factors like marital status, gender, age, education level, and field of study. Evidence suggests that having a college degree increases short-term job opportunities and decreases long-term joblessness. The study assessed variations in unemployment rates among graduates in different countries. Graduates with higher education in Belgium, Ireland, and the United Kingdom had the lowest chances of being unemployed, while those from Germany, Italy, and Ireland were least likely to face long-term unemployment. Similar work opportunities are available in several career fields. Medicine, engineering, and science education have the lowest unemployment rates among occupations.

Lučkaničová et al. (2012) developed statistical models to explain selected variables' effect on Slovakia's employment between 2005 and 2009. The probability of employment is based on personal data from the EU and SILC Statistical Survey, in conjunction with several socio-economic factors. The highest degree of education attained positively impacts employment, as supported by research. The study employs logistic regression as a prediction model, regardless of whether the dependent variable is binary or takes the value one if a person is employed and 0 if the individual is unemployed. Because the observed values for the dependent variable are not scaled and there is no necessity for a normal error distribution, linear regression is inappropriate (Hosmer et al., 2013).

Using logit and probit analysis models, Andrei et al. (2016) examine the impact of education on labor force participation decisions, as this variable is particularly important to developing nations. The investigation results indicate that the likelihood of entering the labor market increases with education level. This pattern is evident among all ethnic groups in Rome, Italy. However, the responsiveness of the labor force participation rate to educational attainment differs significantly between racial and ethnic groups, with Roma showing the most significant sensitivity. Therefore, public policy in Rome must seek to enhance participation at all levels of schooling.

Okicic et al. (2020) demonstrate that education is one of the most influential factors in determining juvenile employment status. Using a logit model, the authors estimated the impact of personal and familial factors on the employment probability of young people in Bosnia and Herzegovina. According to the survey, education, age, gender, and unique household characteristics increase the likelihood of juvenile employment. The paper is envisaged to create information that will benefit government decision-makers in Bosnia and Herzegovina in implementing youth-supportive employment policies.

In addition, probabilistic models (probit and logit) are optimal for assessing binary dependent variables (Aldrich & Nelson, 1984; Christensen, 2006). The outputs of the probit and logit models are frequently almost similar, the decision between them is arbitrary (King & Zeng, 2001; Kwak & Clayton-Matthews, 2002; Hahn & Soyer, 2005).

## Research Methodology

### *Empirical Model*

Every worker who enters the labor market has two statuses: employed and unemployed (Bureau of Labor Statistics, 2021). According to Lurweg (2010), the individual characteristics of employees influence their employment status. The following characteristics are controlled for employees' training level, age, gender, and place of residence (Wolbers, 2000; Theodossiou & Zangelidis, 2009; Lurweg, 2010; Westerheide & Kauermann, 2014). Royalty (1998), Nilsen, Ris & Torstensen (2000), and Albanesi & Kim (2021) emphasize the significance of gender in the transition from employment to unemployment; therefore, a dummy variable for gender is employed. In order to control for regional heterogeneity, it is necessary to include a dummy variable for the region where the employees reside (Westerheide & Kauermann, 2014). Include a set of temporal dummy variables to control for the time heterogeneity of the unobserved variable (Albanesi & Kim, 2021; Cortes & Forsyth, 2023).

Lurweg (2010) and a number of other authors select the binomial model because certain assumptions of the standard OLS regression cannot be modified if the dependent variable is not a continuous random variable. In addition, the errors ( $u_i$ ) are frequently not normally distributed and are heterogeneous. In addition, the dependent variable's regression predictor values may fall outside the 0/1 range. The marginal effect of a one-unit increase in the explanatory variables does not necessarily result in a constant, linear increase in the dependent variable (Gujarati & Porter, 2008). On the binary variable of employment status, these problems can be solved by Logit or Probit regression.

Logit regression was conducted to analyze the effects of vocational training on the capacity to obtain paid employment, and the logistic regression equation is provided below.

$$L_i = \text{Ln} \left( \frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + u_i \quad (1)$$

Where the coefficients  $\beta_0, \beta_2, \dots, \beta_k$  are the estimated coefficient of the Logistic regression model by the method of maximum likelihood;  $X_1, X_2, \dots, X_k$  are independent variables in the model;  $L_i$  is the natural logarithm of the ratio between the probabilities of having and not having a job. The investigation calculated the odds ratio (OR) according to Cornfield (1951), Hailpern & Visintainer (2003), and Pearce (2019) for ease of interpretation. If the OR rate is greater than one unit, then a one-unit increase in  $X$  will increase the employment rate. In contrast, the employment rate falls when the OR ratio is less than one.

In this study, the authors employ the Logit probability regression model with the binomial variable of employment status (Prob) as the dependent variable. Prob has a value of 1 if the individual is employed and 0 if they are unemployed or have unpaid labor.

$$\text{Log} \left( \frac{\text{Probi}}{1-\text{Probi}} \right) = \alpha_0 + \alpha_1 \text{age}_i + \alpha_2 \text{age}_i^2 + \alpha_3 \text{skill2}_i + \alpha_4 \text{skill3}_i + \alpha_5 \text{Sex}_i + \alpha_6 \text{Sex}_i * \text{Skill2}_i + \alpha_7 \text{Sex}_i * \text{Skill3}_i + \alpha_8 \text{Rural}_i + \alpha_9 \text{year2016} + \alpha_{10} \text{year2018} + \epsilon_i \quad (2)$$

Index  $i$  is the index corresponding to the  $i$ th laborer in the data.

Among the independent variables are: The age variable is the employee's age; The variable skill2 is a dummy variable about workers through vocational training (receiving the value of 1 if the employee has a degree or vocational certificate, 0 otherwise); The variable skill3 is a dummy variable on labor at college or university level or higher (values equal to 1 if the employee has a college or university degree or higher, and 0 if it is

another level); The sex variable, which represents gender, gets the value 1 for males and 0 for females; The variable Sex\*Skill2 is the interaction variable between the gender variable and the vocational training variable; The variable Sex\*Skill3 is the interaction variable between the gender variable and the variable of college-level training or higher; the Rural variable is a dummy variable that takes the value of 1 if in urban areas, 0 if in rural areas; The dummy variable year 2016 and 2018 aims to examine how the effects of employment policy in 2016 and 2018 are different from the base year 2014.

The component  $e_i$  represents the model's random error.

Estimating the coefficients  $\beta$  of the Logit model using the ML method instead of OLS.

The marginal effect of the independent variable X on the probability that the dependent variable will receive the value 1 is as follows:

$$\frac{\delta P}{\delta x} = p(1 - p)\beta$$

The preceding formula shows that the marginal effect of variable X depends on the estimator and the probability p-value for given conditions, typically the mean value of the independent variables.

#### Data

The study utilizes data from the Vietnam Household Living Standards Survey (VHLSS) from 2014 to 2020. This is a sampling survey with generalized weights conducted by the General Statistics Office every two years. According to the Government of Vietnam's classification criteria, ethnic minority regions are communes with at least 15% of ethnic minority households (The Prime Minister of the Government, 2020). Since VHLSS data contains identifying information for households, such as province, district, commune, area, household code, and information on the ethnic composition, the study uses criteria for classifying ethnic minority regions to determine which Northwest households belong to the Northwest ethnic minority region. Table 1 displays the size of the sample for this study.

**Table 1.** Sample size of the VHLSS

Year	Number of surveyed households	Number of surveyed people	Number of Northwest sample participants	Number of participants in Northwest ethnic minority region
2014	9,354	35,920	2,763	2,608
2016	9,359	35,640	2,793	2,608
2018	9,371	34,996	2,821	2,642
2020	10,155	38,132	2,875	2,631

Source: Calculation based on VHLSS

## Results and Discussion

In the Northwest ethnic minority region, the overall number of employed trained workers decreased in 2016, somewhat rebounded in 2018, and then rose in 2020. Male employment is declining consistently over the years, whereas female employment displays greater fluctuation, experiencing a notable increase in 2020 (see Table 2).

Table 2 shows a notable disparity in the employment figures of skilled male and female workers from 2014 to 2018. By 2020, the disparity has significantly decreased.



**Table 2.** Employment of trained workers from 2014 to 2020

• *Unit: Person*

Year	2014	2016	2018	2020
<b>Sex</b>				
Female	58,336	63,431	47,039	81,928
Male	172,120	153,225	170,403	149,340
<b>Age</b>				
From 15 to 24	43,711	61,140	13,529	12,662
From 25 to 29	33,072	28,769	35,101	47,631
From 30 to 34	33,583	29,410	47,543	54,379
From 35 to 39	19,900	17,879	31,563	45,020
From 40 to 44	12,158	16,285	20,449	29,054
From 45 to 49	25,076	22,621	26,710	20,096
From 50 to 54	47,116	26,388	26,897	18,909
Above 55	15,840	14,164	15,650	3,517
<b>Areas</b>				
Urban	93,605	72,983	82,068	91,113
Rural	136,851	143,673	135,374	140,155
<b>Ethnicity</b>				
Ethnic Minorities	96,658	118,225	109,475	122,851
Kinh/Hoa	133,798	98,431	107,967	108,417
<b>Total</b>	<b>230,456</b>	<b>216,656</b>	<b>217,442</b>	<b>231,268</b>

**Source:** Calculation based on VHLSS

The demographic composition of skilled workers has undergone substantial changes over the years. In 2014, the group of workers aged 50 to 54 made up the largest portion of trained workers, with 47,116 individuals (about 20.44% of the total employees). By 2016, this number dropped to 26,388, a decrease of 20,728 people (nearly 44% decrease rate). In 2020, the number further declined to 18,909 workers in this age group. In 2016, the highest number of trained workers shifted from the 50-54 age group to the 15-24 age group. The number of workers with the most vocational training in 2016 was 61,140, which accounted for almost 30% of workers who received vocational training that year. This marked an increase of 17,429 employees from 2014. Only 12,662 workers in this age group acquired vocational training in 2020, which is a decline of about 79% compared to 2016. In 2018, there were 47,543 trained workers aged between 30 and 34, which remained the highest number of trained workers in 2020. Table 2 shows those over the age of 55 are generally the least enthusiastic about vocational training, representing only 1 to 8 percent of the total number of trained workers annually.

More rural workers than urban workers acquire vocational training. In 2016, the urban workforce receiving vocational training and finding employment decreased by 20,622 individuals, while in rural areas, the number of workers receiving vocational training and securing employment locally increased by over 6,800 people, representing an almost 5% rise from 2014. The urban-trained workforce increased by over 18,000 individuals from 2016 and over 9,000 from 2018, whereas the rural-trained workforce declined. The government's vocational training policy is evidently prioritizing rural workers to enhance the number of rural workers undergoing vocational training to help them earn a livelihood and enhance their skills. labor within their designated area.

Over time, the ethnic distribution of vocationally qualified people employed in ethnic minority regions becomes more equitable. In 2014, 133,798 individuals with vocational training were employed in the Kinh/Hoa ethnic group, accounting for over 58% of the workforce. By 2016, the proportion of ethnic minorities with vocational training who were employed had risen and surpassed that of the Kinh/Hoa group. The government's increased focus on vocational training for ethnic minorities aims to assist them in achieving stability, alleviating hunger, reducing poverty, and decreasing dependence on rural agriculture, marking a significant endeavor.

Table 3 displays the estimated results of the Probit model for estimating the likelihood of paid employment and the capacity to work in agriculture for trained and untrained workers.

**Table 3.** Results of Analysis on the Influence of Vocational Training on Job Opportunities

VARIABLES	(Model 1) Probability of being wage/salary employees	(Model 2) Probability of obtaining a job in the agricultural sector
Age	0.374*** (0.000)	0.352*** (0.000)
age2	-0.005*** (0.000)	-0.004*** (0.000)
skill2	1.191*** (0.004)	-1.779*** (0.004)
skill3	2.756*** (0.004)	-1.945*** (0.004)
Sex	1.047*** (0.002)	-0.099*** (0.002)
sex_skill2	-0.531*** (0.005)	0.323*** (0.005)
sex_skill3	-0.900*** (0.006)	-0.445*** (0.006)
Rural	-0.084*** (0.002)	2.481*** (0.002)
2016.year	-0.039*** (0.002)	-0.113*** (0.002)
2018.year	-0.081*** (0.002)	-0.377*** (0.002)
2020.year	0.183*** (0.002)	-0.398*** (0.002)
Constant	-7.606*** (0.005)	-7.121*** (0.004)
Observations	8,375	8,375

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The estimated results indicate that the employment prospects of vocationally trained workers increase with age. This is the case when older workers have much experience in life, labor, and production, and businesses require them to pass on their wisdom to younger workers. Young workers absorbing knowledge will gradually increase productivity. The length of time a worker has been employed greatly affects their job prospects as their experience and skills develop, leading to changes in their productivity and wages. This aligns with Becker's human capital theory (Becker, 1967). Adults who are capable of working desire to be

employed and positively impact society, and they will proactively seek opportunities to generate employment for themselves.

Employees' salaries and income are positively correlated with their seniority and age. As individuals age, their labor capacity diminishes, leading to health constraints and decreased job opportunities. Employment prospects for workers will increase until reaching a particular age, then decline as a result of health concerns and the aging process. The employment opportunity of workers is maximized when the first derivative of the probability variable for an employment opportunity with respect to age is zero. In model 1, the estimated coefficient for the variable age<sup>2</sup> is -0.005, and for the variable age is 0.374. This suggests that workers have the most lucrative employment prospects up to the age of 37.4 (calculated as 0.374 divided by twice 0.005), after which the prospects decline. This could be appropriate for ethnic minorities in the Northwest, where the labor market is underdeveloped and there is low demand for jobs. Vocationally trained workers who conduct manual labor and produce directly may find it challenging to secure a new paid position after the age of 37.4 due to the nature of their occupation. Agricultural laborers may find it challenging to secure employment after the age of 44, which is 6.6 years older than skilled workers. Agricultural workers mostly rely on income from agricultural and animal operations due to their access to land, fields, and gardens for cultivation. Vocational training individuals depend on their employers' guidelines for productivity, unlike non-agricultural workers.

A mature market economy provides increased work prospects for individuals with advanced professional degrees. The coefficients in model 1 show that a trained worker is much more likely to secure a salaried position than a person without a degree or certificate. An individual's probability of securing a job is directly related to their educational attainment and technical skills. Estimating model 2 yields contradictory outcomes. Highly qualified workers are more prone to leaving jobs in the agricultural sector. This is a prevalent pattern in quickly industrializing countries such as Vietnam.

The coefficient for the variable "sex" in model 1 indicates that male workers are more likely to seek employment than female workers, with an estimated coefficient of 1.047. The interaction variables between the skill variable and the sex dummy variable (sex skill<sup>2</sup> and sex skill<sup>3</sup>) have negative estimators of -0.531 and -0.9, respectively. This suggests that male workers with the same qualifications have less favorable employment opportunities compared to female workers with the same qualifications. This could be attributed to the elevated compensation of male employees or increased labor expenses for male workers compared to female workers. Female workers are often well-suited for vocations that demand meticulousness and care, and they excel in roles that are crucial to Vietnam's current workforce. The agricultural sector is not exempt. Women in the Northwest of Vietnam are more inclined to work in agriculture compared to men. Individuals with a college-level education or above are more likely to leave agricultural labor if they are men rather than women. In Vietnam's agriculture sector, the majority of workers are women, whereas men tend to pursue vocations that involve specific skills or physical strength. Furthermore, with the modernization and industrialization of agriculture, new technologies are being implemented to enhance efficiency and decrease labor-intensive duties for workers.

In model 1, the predicted value of the variable "rural" is negative, suggesting a difference in employment opportunities between urban and rural people. Urban workers are less likely to have employment compared to rural workers. Workers involved in urban agriculture are more likely to find jobs compared to those residing in rural regions. The main reason is the scarcity of agricultural laborers in cities, which raises job seekers' chances of finding work. Living in an urban area provides these people with improved living conditions and increased work flexibility, which enhances their career opportunities.

The estimated findings of both models indicate that the probability of vocationally trained workers getting jobs in 2016 and 2018 is lower than in 2014. The increase in unemployment during those years may be attributed to the government's macroeconomic policies. In 2020, job prospects for skilled workers declined significantly compared to 2014, whereas the agriculture sector remained below its 2014 levels. The COVID-19 pandemic is expected to significantly alter how individuals



and organizations view work and jobs, leading to changes in the realm of employment (Kramer & Kramer, 2020).

## Conclusions and Policy Implications

The study analyzed how vocational training affects the job opportunities of ethnic minority workers in the Northwest region. It utilized a logistic regression model that considered factors such as age, gender, geographic location, and vocational training status. The study measured the percentage of working-age individuals from ethnic minority groups participating in vocational training. The study found that the probability of being employed rises with age until reaching 37.4 years and 44 years in the field of agriculture, after which it begins to decrease. Individuals lacking technical proficiency are at a disadvantage compared to those with vocational education when seeking employment. Apprentices have better work opportunities compared to college and university graduates. The study emphasizes a notable transition of proficient workforce from agriculture to alternative sectors due to improved job prospects and earnings. The probability of having a job differs based on gender, location, sector, and timeframe.

To expand employment prospects for ethnic minority employees in Vietnam, the government must design a local vocational training strategy that integrates vocational training programs with socio-economic development localities, with special emphasis on:

First, to fully utilize the advantages of vocational training for human resources in ethnic minority regions, it is crucial to incorporate vocational training content for workers into local socio-economic development programs. This can be accomplished by creating supportive mechanisms that enable this integration.

Second, there is a framework to encourage vocational training under the guiding principle of socialization, with the function of the state as supervisor. In order to create suitable vocational training models, it is essential to combine forms of socialization in vocational training, such as the collaboration of state agencies with the state economic sector to conduct vocational training, coordination with socio-political or socio-professional organizations to organize mass vocational training in the localities, and collaboration with groups of craft villages to organize the teaching of traditional crafts.

Third, to satisfy the human resource needs of each locality, it is vital to attach importance to vocational advice and vocational training for ethnic minority workers in conjunction with the planning of agricultural development and new rural construction. These institutions build vocational training institutions, enhance training quality and efficacy, and suit each locale's manufacturing, business, and economic development demands. The age of workers must be considered in vocational training plans to realize their full potential, maintain their health, and have greater opportunities to obtain employment, no longer burdening families and society.

Fourth, there is a strategy to encourage businesses to integrate vocational training with the employment of workers from ethnic minority regions who have received vocational training. Supplement and complete policies to attract and encourage enterprises to invest in ethnic minority and mountainous areas and to support enterprises in training and employing local laborers, particularly ethnic minorities; assign training and employee development responsibilities to agencies and units employing ethnic minority workers.

Fifth, to further stimulate economic growth, it is essential to increase the attractiveness of foreign investments and employ aid contributions from international organizations and individuals to facilitate vocational education for disadvantaged ethnic groups.

### *Data availability*

The datasets generated during and analyzed during the current study are available from the corresponding author upon reasonable request.

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