Impact of Vocational Education and Training On Decent Job Opportunities Regarding Information and Communication Technology

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Abstract: Vocational education and training plays a crucial part in the creation of decent job. The fast growth of information and communication technology (ICT) during the past ten years has increased work opportunities for laborers. This research uses the yearly labor force survey data to study the impact of vocational education and training on decent job opportunities for employees in the context of Vietnam's information and communication technology development. The logit model results indicate that the 2020 rate of decent jobs is still low, at approximately 25.6 percent. However, vocational education and training and the advancement of ICT positively affect decent job opportunities. This long-lasting impact affects laborers in various areas, regions, and industries. These findings suggest that vocational education and training and ICT must play a significant role in transitioning from precarious to more secure employment, so laborers must acquire professional knowledge and information technology skills.

Keywords: Decent job, ICT, laborer, vocational education and training

1.   Introduction

Vocational education and training has been demonstrated to be essential for skill development. Its feature that focuses on particular vocations has enabled people to locate skill-related jobs or begin employment (Bhurtel, 2015). In Vietnam, the present distribution of employment by skill levels, 53 percent of positions in the country are medium-skilled, and 12 percent are high-skilled. The remainder is low-skilled (36 percent). In the meanwhile, upper-middle-income nations have a comparable percentage of low-skilled occupations (32 percent), a lower share of medium-skilled jobs (48 percent), and a far larger share of high-skilled jobs (20 percent, almost twice as large as Vietnam) (International Labour Organization, 2019). Vietnam must solve this vast obstacle to achieve its goal of being an upper-middle-income nation by 2030 (International Labour Organization, 2021).

One of the biggest challenges for Vietnam and other developing countries is the creation of sufficient and quality employment. According to global surveys of public opinion, employment issues (or the lack thereof) are among the top concerns of the populace (European Union, 2018). Possibilities for productive work that provide a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize, and participate in decisions that affect them, and equal opportunity and treatment for all men and women are all elements of the decent job (International Labour Organization, 2013). Indeed, a decent job is central to individual and societal well-being, contributing to improved living conditions, poverty reduction,

and social cohesion. Vocational training is a significant determinant of employment. Although it does not produce jobs independently, it helps individuals compete for available positions and maintain employment (International Labour Organization, 2001).

The use of information and communication technology (ICT) alters the labour processes and invents new forms of work organization (World Bank, 2013). This has paralleled the accentuated growth of globalization and reformulations of work organizations in most economic activities. Informationalism has set into all societies and has led to several reconsiderations affecting labour flows and processes. Institutions involved with the labour problem have begun to reconsider their concepts and categories in a new light. Of various reconsiderations, the question of a decent job has emerged as a comprehensive term of a new paradigm during the turn of the last century. With the advent of ICT, the issue of decent jobs has gained added importance because of the structural properties immanent in the ICT sector and the anticipated impacts on development and labour processes.

To increase their employment chances in the labour market, labourers must be equipped with the necessary ICT skills and technical knowledge (Başlevent & Onaran, 2004). In addition, skilled labourers require training assistance for more stable careers.

This empirical research contributes to this field of study in several ways. First, it is a first-of-its-kind investigation into the empirical influence of vocational education and training on decent job chances with varied ICT levels – something that has not been done previously. Second, in order to provide an up-to-date policy-oriented debate, this analysis utilizes the most recent time frame of new data. Thirdly, significant implications for ICT-related vocational education and training policies are anticipated to be derived from this research's findings.

2.   Literature Review

The concept of a "decent job" was launched in 1999 in the Director-General's Report to the International Labor Conference meeting (Burchell, Sehnbruch, Piasna, & Agloni, 2014). The expression summarizes the vast and various work characteristics in a way that everyone can understand and appreciate (Ghai, 2003). Employment, fundamental values and rights at work, social protection (social security and labour protection), and social dialogue are the four interdependent and mutually complementary strategic objectives that constitute a decent job. Gender equality and non-discrimination are transversal concerns (International Labour Organization, 2008). Due to its importance, the Sustainable Development Goals (SDGs) contain multiple facets of decent jobs as the main method for reducing poverty. Access to the decent job has become a crucial global concern in this situation. International Labour Office (2013) considers a decent job to be a fundamental human right and one of the main challenges the world is facing.

Di Fabio and Maree (2016) distinguished philosophical, legal, economic, sociological, and psychological viewpoints in a cross-disciplinary examination of the notion of a decent job. The philosophical viewpoint (Peruzzi, 2015) emphasizes the concept of dignity and how belonging culture might influence it. The legal viewpoint underlines the labour law system, which should facilitate access to new employment prospects and promote employability laws (Hepple, 2001). The economic viewpoint (United Nations Economic and Social Council, 2006) highlights "the right of everyone to enjoy just and favourable working conditions," reiterating the concepts of fairness, safety, equal opportunity, and respect for human rights (United Nations Economic and Social Council, 2006). The sociological viewpoint refers to how the definition of a decent job has evolved: the International Labor Organization's 1999 definition was expanded in 2015 (International Labour Organization, 2015). Consequently, the four initial viewpoints emphasized by the International Labor Organization (labourers' rights, employment, social protection, and social dialogue) evolved into the promotion of employment, the guarantee of labour rights, and social protection, which includes inclusion, and the promotion of social dialogue. The psychological viewpoint reflects a decent job in terms of (i) job satisfaction, which refers to the labourer's expectations at work and the perception of the quality of work (Agassi, 1983); (ii) intrinsic quality of work, which refers to the well-being of labourers, which the strategies adopted by employers also guarantee; and (iii) the desirability of work, which refers to the objective characteristics of work that can promote labourers' aversion to work (Burchell, Sehnbruch, Piasna, & Agloni, 2014).

Each labourer entering the labour market has two statuses, employed or unemployed. According to Lurweg (2010), the employment status of labourers is affected by their individual characteristics of the labourers. The following personal characteristics are controlled: training level, age, gender, and areas where the labourer lives in the area. Royalty (1998) emphasizes the importance of gender in the transition from work to unemployment, so a dummy variable for gender is used. Employment opportunities vary from region to region, so to control for regional heterogeneity by including a dummy variable for the area where labourers live. Furthermore, control for time heterogeneity of the unobserved variable by including a set of temporal dummy variables. Hutchens (1988) supports the hypothesis that job opportunities decline with age. In particular, women, minorities, and labourers may confront narrower job choice sets than others.

Vocational education and training are essential attributes that make a labourer employable in a decent job. Do et al. (2020) use the Heckman Sample Selection Model to estimate the effect of vocational training on the wages of labourers in ethnic minority areas of Vietnam. The results indicate that vocational training plays a significant influence in increasing the salaries of ethnic minority labourers, which is a requirement for a decent job. However, Narayanan & Nandi (2017) show that most skilled labourers are employed as informal labourers receiving no employment benefits. Two main reasons may explain why skilled labourers cannot find decent jobs. First, the low quality of technical education and

vocational training produces low-skilled labourers, who remain unemployable even after obtaining technical and vocational training. Second, demand-side bottlenecks can be addressed through reforms in the existing labour laws and educating the firms on the benefits of formal jobs.

In China, general education typically has a higher participation rate than vocational education because higher education has more social recognition, and it is easier for students to obtain a decent and stable job position. Under a higher youth unemployment rate, students may prefer to choose general education to have job competition in the labour market. The other reason is that the education quality in vocational education is not as good as in general education. Improving vocational education quality could be one of the most direct ways to improve its recognition (Huang & Zhang, 2021). Dummert (2020) affirmed that in Germany, vocational training graduates have good job opportunities. However, not all students have jobs after graduating from vocational training. Unemployment after apprenticeship still exists. Individual characteristics and geographic regions influence the ability to transition from vocational training to formal employment. However, only half of the German men and 60 percent of women have jobs that match their trained occupation. The fit between vocational training and the job also varies across career stages. Vocational training seems to be more important early in a career, equipping labourers with initial skills, and erodes over time as vocational knowledge becomes obsolete; human capital such as work experience and on-the-job training is cumulative (Witte & Kalleberg, 1995). To make sustainable progress, Pakistan must concentrate on developing the skills of its youth in accordance with local and international markets so that it can lead them to a decent job and a standard living environment. The only solution to the country's problems is an investment in human resources (Chamadia & Shahid, 2018).

ICT deployment and adoption have enabled new work organization and management modes. This may have disturbed the existing labour market conditions (Basant & Rani, 2004) and immensely benefited labourers in developing countries (Kelkar & Nathan, 2002). As advocated by some researchers, there may be a transition from an industrial to an information society to facilitate globalization and ICT deployment. The information society is characterized by a highly skilled and knowledgeable workforce that works in better organizations. Felstead, Fuller, Jewson, and Unwin (2011) observed a shift toward high productivity and skill development. This modification marked the shift to "flexible work."

Technology provides disadvantaged individuals with access to employment opportunities despite age, health, education, or status limitations. Toboso (2011) utilized the capacity approach and focused on ICT adoption to promote equality and opportunity. In that study, it was proposed that ICT plays a crucial role in the lives of the disadvantaged. Raja, Imaizumi, Kelly, Narimatsu, and Paradi-Guilford (2013) affirmed that ICT contributes to creating new ICT jobs and promoting an inclusive, innovative, flexible, and transparent labour market. This study was the first step in the World Bank's efforts to determine how ICT moulds, transforms and alters labour markets. As an outcome, governments and other stakeholders were advised of a variety of ways to increase employment possibilities as a result of ICT development. Dachs (2017) also discussed the influence of ICT on employment chances. Consideration was given to both positive and negative outcomes.

Consequently, labourers typically possess a high level of ICT knowledge and experience to fulfil their occupations' requirements. On the other side, high criteria result in more significant hurdles and obstacles for the personnel. The elimination and dismissal of unqualified labourers will occur gradually. Dachs (2017) and Melia (2019) assessed the opportunities and challenges to employment offered by ICT advancement. ICT enables unprecedented levels of automation, rendering millions of daily occupations obsolete and encouraging the creation of new positions. Therefore, policymakers must be aware of the potential and risks presented by digital technologies to maximize the benefits while preserving a legal framework to reduce the negative ones.

ICT covers essential components of contemporary infrastructure, with significant applicability in worldwide economies (Pradhan et al., 2015). Many research used principal component analysis (PCA) to create the ICT composite index, despite the lack of standardization and availability of data regarding ICT for all nations. Bivariate analysis is used to determine the strength of the relationship between two variables, whereas multivariate analysis is used to determine the composite power of association (Singh et al., 2009). The PCA is the most used multivariate technique used to create composite indexes in the scientific literature (Pradhan et al., 2014; Singh et al., 2009; Lai, 2003). The fundamental premise of the PCA technique is to identify patterns among variables and to enable the redaction of data into a new composite index that consolidates these associated variables (Gupta et al., 2018).

3.   Research Methodology

In this study section, we represent the method from setting up an empirical model, source of data collection, instrument and data analysis process to get our research objectives.

3.1   Empirical Model

In this research, a probability regression model with a binary variable was used to examine the effect of vocational education and training on decent job opportunities regarding ICT, with the binary variable equaling 1 if the labourer has a decent job or 0 if the labourer does not have a decent job, as several authors have previously done (Başlevent & Onaran, 2004).

Suppose a response variable Y is binary, that is it can have only two possible outcomes which we will denote as 1 and 0. We also have a vector of regressors X, which are assumed to influence the outcome Y. Specifically, we assume that the model takes the form: $\Pr(Y=1|X) = \Phi(X^T\beta)$, where Pr denotes probability, and Φ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters β are typically estimated by maximum likelihood.

It is possible to motivate the probit model as a latent variable model. Suppose there exists an auxiliary random variable

$Y^* = \beta X + \varepsilon$, where $\varepsilon \sim N(0,1)$. Then Y can be viewed as an indicator for whether this latent variable is positive:

$$Y = \begin{cases} 1 & Y^* > 0 \\ 0 & otherwise \end{cases} \tag{1}$$

x is composed of vectors indicating socio-demographic factors like gender, age, degree of vocational education and training, marital status and a macro variable that carry provincial data. It measures the impact of interprovincial ICT-level disparities on decent job opportunities.

Lurweg (2010) and some other authors chose the binomial model to evaluate employment opportunities because certain assumptions of the standard OLS regression cannot be modified if the dependent variable is not continuous random data. Notably, the marginal effect of a one-unit increase in the explanatory variables does not necessarily correspond to a constant, linear increase in the dependent variable (Gujarati & Porter, 2008). Moreover, the errors (ui) are frequently not customarily distributed and heterogeneous, which poses a problem. The dependent variable's regression predictor values may fall outside the 0/1 interval. These problems can be solved with Logit or Probit regression on the binary variable of employment status.

Essentially, the probit model may be depicted as follows:

$$\text{Log}\left(\frac{\text{Probij}}{1-\text{Probij}}\right) = \beta_0 + \beta_1 gender_{ij} + \beta_2 Index_j + \beta_3 skill2_{ij} + \beta_4 skill3_{ij} + \beta_5 age_{ij} + \beta_6 age2_{ij}$$
$$+ \beta_7 married_{ij} + \beta_8 urban_{ij} + \beta_9 Region_{ij} + \beta_{10} branch_{ij} + \beta_{13} years + e_{ij} \tag{2}$$

Where i represents laborer i, which refers to laborer i in province j, given the abovementioned variables.
Gender is a dummy variable (taking the value of 1, indicating male, or 0, indicating female).
The index represents the provincial ICT index, determined by three key criteria: technical infrastructure, human resources infrastructure, and IT applications.

Skill2 and skill3 are dummy variables standing for, respectively, vocational training and mid-term professional training; college, university, and higher. It was assumed that the higher the level of human capital shown by educational attainment, the better the rate of return (Heckman, 2000). Age and age2 represent the labourer's age and age squared, which is the experience variable. Married represents the labourer's marital status, equal to 1 if married, and vice versa.

The suggested control variables are as follows: Dummy variable urban (taking the value 1, indicating urban areas, or 0, indicating rural areas) for differentiating decent job opportunities in rural and urban areas; dummy variables regions to analyze differences in decent job opportunities by socio-economic region; dummy variables branches to control industry elements; the variable years as control macro factors.

Maximum Likelihood Estimation rather than Ordinary Least Square is used to estimate the β coefficients of the Logit model. The marginal effect of the independent variable X on the likelihood that the dependent variable will take on the value 1 is as follows:

$$\frac{\delta P}{\delta x} = p(1-p)\beta \tag{3}$$

According to the above formula, the marginal effect of the variable X relies on the estimated coefficients β and the probability value p, typically at the mean values of the independent variables.

3.2 Data

This research employs a composite index of information and communication technology. This index is derived using the PCA technique. The data must first be sorted in the same order to generate an input matrix for the principal components, followed by a min-max normalization method. Second, Eigenvalues, factor loadings, and principal components are determined. Thirdly, the principal components are used to generate the three indices for each province and year independently. Several studies, notably Pradhan et al. (2016), provide specifics on these steps.

The data set includes yearly labor force survey data from 2016 to 2020 collected by the General Statistics Office and the ICT index for 63 provinces collected by the Ministry of Information and Communications. The ICT data for 63 provinces from 2016 to 2020 is linked with those provinces' labor force survey data. The statistics from the labor force survey contain information on employees, employment, and incomes. The ICT data of 63 provinces include the Technical

Infrastructure Index (TI Index), the Human Resource Infrastructure Index (HRI Index), the ICT application index (ICT App Index), and the composite index that measures the level of preparedness for ICT application and development (ICT Index) (see Table 1).

Table 1 - Vietnam's ICT index and component indices

Year	2016	2017	2018	2019	2020
ICT Index	**0.484**	**0.475**	**0.467**	**0.450**	**0.457**
TI Index	0.370	0.387	0.372	0.371	0.494
HRI Index	0.599	0.534	0.590	0.616	0.627
ICT App Index	0.485	0.504	0.437	0.362	0.250

Source: Authors' calculations based on provincial ICT statistics

The concept of a decent job encompasses job creation, job security, and job quality. Employment opportunity, social security, working conditions, and social dialogue have been selected from Ghai (2003) and the International Labor Office (2013) as the four interconnected broad elements of a decent job for this article (2013). Based on annual labour force survey data, a labourer is determined to have a decent job if his/her income is above the low level (above 2/3 of the median income), has a labour contract, participates in social insurance, and guarantees working hours.

The provincial ICT index is divided into three tiers to analyze the impact of vocational education and training on the decent job rate regarding ICT. Level 1 comprises the 21 provinces with the highest ICT index (Hight ICT), level 2 comprises the 21 provinces with a medium ICT index (Medium ICT), and level 3 comprises the 21 provinces with the lowest ICT index (Low ICT). The above model is estimated with three ICT tiers to assess the impact of ICT on decent job opportunities in each tier.

4.   Results and Discussion

HRI and TI indices improved from 2016 to 2020, while the ICT App Index fell by almost half. Consequently, the ICT application and development readiness composite index remained constant (see Table 1).

From 2016 to 2020, decent job rates increased in all areas and regions, as shown in Table 2. The rates in urban areas were generally higher than those in rural areas; the Southeast had the highest rate (46.2 percent), and the Central Highlands had the lowest rate (9.3 percent). In contrast to the low decent job rates in the non-state sector, decent job rates were very high in the foreign investment and state sectors.

Table 2 - Decent job rates by areas, regions, and sectors (%)

Year	2016	2020
Areas		
Urban	38.5	39.8
Rural	13.6	18.7
Regions		
Red River Delta	29.0	34.7
Northern Midlands and Mountains	12.9	16.6
North and South Central Coast	15.7	17.8
Central Highlands	8.8	9.3
Southeast	41.6	46.2
Mekong River Delta	12.4	15.3
Sectors		
State	81.8	81.6
Non-state	11.0	14.3
Foreign investment	94.1	92.7

Source: Authors' calculations based on the labour force data in the period of 2016-2020 conducted by the General Statistics Office

Qualifications were correlated with decent job rates. Specifically, the better the qualifications, the greater the decent job rates. In qualification groups with a high ICT index level, decent job rates were higher; hence, vocational education and training and decent job rates were positively connected across all ICT index levels. In 2016, the average decent job rate was 10.9 percent for those with no-technical qualifications, 35.1 percent for those with vocational training, 47.1 percent for those with mid-term professional training, 62.6 percent for college, and 81.6 percent for university and higher. International Labor Organization (2020) believes that around 81 million jobs will be lost as a result of the Covid-19 pandemic in 2020. Each year also has an effect on the loss of working hours. As a result of the region's failure to create new jobs, millions of individuals leave the labor or become unemployed. There has been a sharp decline in both the quality and quantity of work in Vietnam and an increase in fear and stigma associated with COVID-19 exposure in the workplace (Dang et al., 2020). The covid-19 pandemic is the main reason for the decline in decent job rates of workers with degrees in 2020 (see Figure 1).
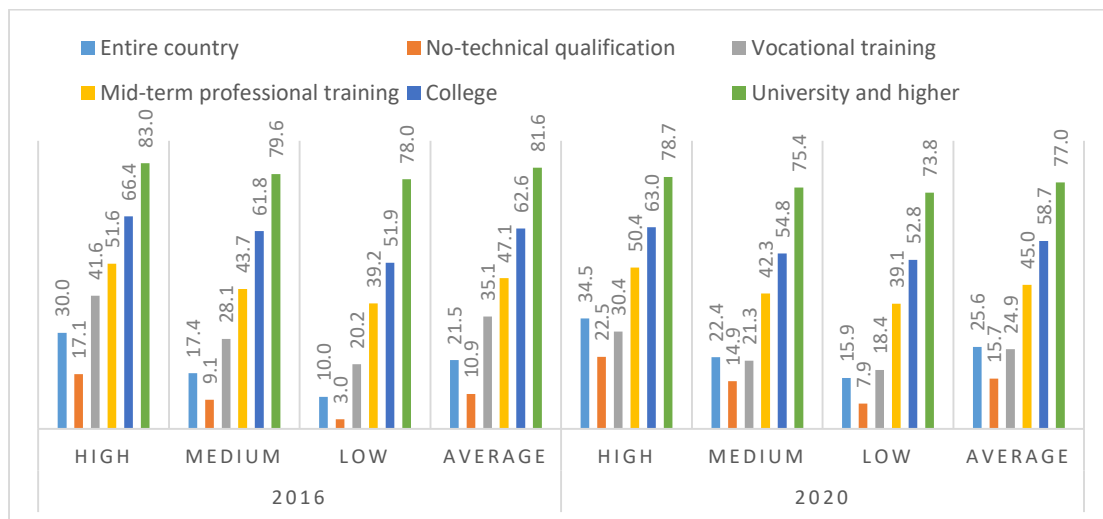

Fig. 1 - Decent job rates by the highest technical qualifications and ICT index levels (%)
Source: Authors' calculations based on the labour force data in the period of 2016-2020 conducted by the General Statistics Office

Table 3 demonstrates a correlation between sex, age groups, and decent job rates regarding ICT. From 2016 to 2020, at each ICT index level, the decent job rates for women were continuously higher than those for men. The rate was 23.4 percent for men and 28.0 percent for women in 2020. By age group, decent job rates were highest among the young and subsequently decreased with age. In 2020, the rate for labourers under the age of 35 was 37.1 percent. It dropped to 23.9 percent for those aged 35 to 54 and 5.1 percent for labourers aged 55 and older.

Table 3 - Decent job rates by sex, age groups, and ICT index levels (%)

ICT index levels	2016				2020			
	High	**Medium**	**Low**	**Average**	**High**	**Medium**	**Low**	**Average**
Entire country	**30.0**	**17.4**	**10.0**	**21.5**	**34.5**	**22.4**	**15.9**	**25.6**
Sex								
Male	28.6	16.6	9.6	20.4	32.5	19.7	14.2	23.4
Female	31.3	18.3	10.4	22.6	36.7	25.4	17.8	28.0
Age groups								
Under 35	43.6	29.5	12.9	32.2	49.5	34.5	21.4	37.1
From 35 to 54	25.8	14.6	10.3	18.8	31.1	21.1	16.1	23.9
Above 55	7.3	3.2	2.2	4.7	8.1	3.3	3.4	5.1

Source: Authors' calculations based on the labour force data in the period of 2016-2020 conducted by the General Statistics Office

Agriculture, forestry, and fishery had the lowest rate of a decent job in 2020, at 0.8 and 0.6 percent, respectively, compared to mining and quarrying (66.2 percent), manufacturing (60.6 percent), and other services (57.9 percent). Generally, places with a high ICT index level have higher rates of a decent jobs in the same industry (see Figure 2).
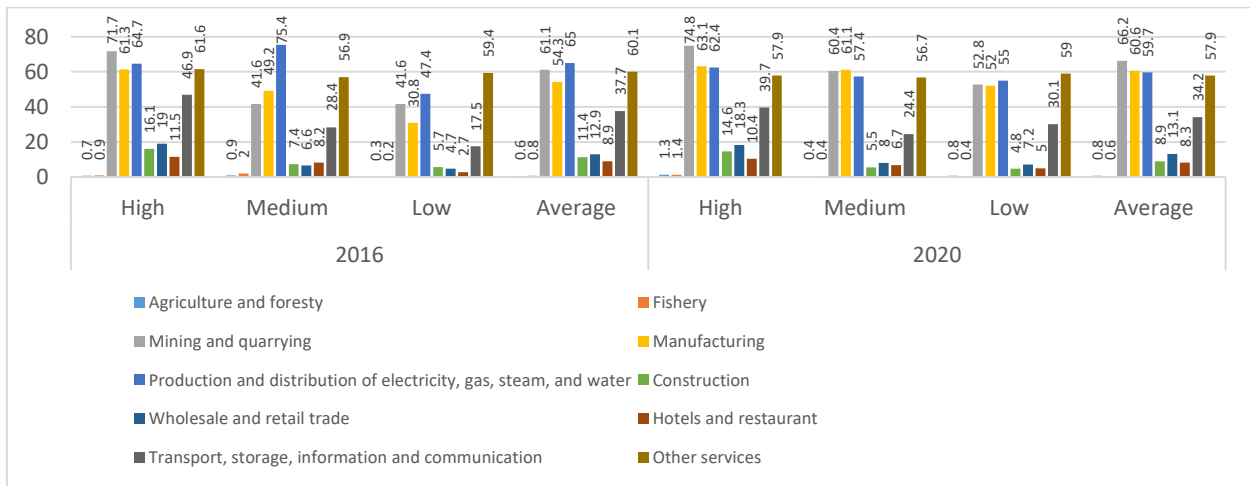

Fig. 2 - Decent job rates by industries and ICT index levels (%)
Source: Authors' calculations based on the labour force data in the period of 2016-2020 conducted by the General Statistics Office

Table 4 presents the model analysis results to assess the impact of vocational training and education and ICT on decent job opportunities. All variables were guaranteed statistically significant with 99% confidence (significance < 0.01). Therefore, the estimation model is suitable.

As the ICT and vocational skills level increases, the probability of labourers getting decent jobs tends to rise. Particularly, when skilled labourers are employed in a region with a higher ICT level, the probability of having a decent job improves dramatically and surpasses the probability of the general population.

Impact of ICT index: When the ICT index increases, the chances of labourers having a decent job increase. In the 2016-2020 period, the development of information and communication has helped firms change their production methods, operate more efficiently, and expand production to take advantage of economies of scale (Spiezia, 2011; Kumar et al., 2016). Employees in the enterprise have better working conditions and improved personal productivity. They can use private information to plan their working hours around personal commitments or their circadian rhythms, working when their productivity is at its highest (Lazear and Gibbs, 2015). Besides, developing information and communication helps labourers quickly learn to improve their qualifications and skills, ICT has an impact on people both positively and badly. The ability of employees to perform their duties and collaborate with coworkers has improved, and there are more flexible working hours as well (De Wet et al., 2016). Employees are guaranteed their rights when working thanks to a quick and convenient information-sharing channel. However, the estimated results also show that the impact of the ICT index on the decent employment opportunities of labourers is different according to the local groups with different levels of ICT development. Specifically, for workers in provinces with low ICT index, the increase in ICT index is still not enough to create satisfactory jobs for labourers. However, in provinces with medium and high ICT, ICT positively impacts labourers' chances of having a decent job.

Effect of training level of employees: The model estimation results show that labourers with Vocational training and mid-term professional training (skill2) and College, university and higher (skill3) qualifications have higher decent job opportunities than the untrained group. If comparing models, it is found that the estimated coefficients of the variables reflecting the training level all are higher in the group of localities with high ICT levels. This result reflects that ICT creates an environment to create decent jobs, but trained labourers, combined with ICT development, will help workers get better decent job opportunities.

Additional variables, including the age, gender, and marital status of labourers, were incorporated to control the impact of individual characteristics on the availability of decent jobs. In provinces with varying levels of information and communication technology, the likelihood of obtaining a decent job differs dramatically for individuals with the same traits.

The inclusion of urban, rural, and socio-economic regions reflects the diversity in decent job rates in areas and regions with varying degrees of economic development. Industries were added to examine if decent job rates were affected by industries.

Time was included to control macro variables with the potential impact that was not seen in this model but had the ability to do so. Alongside socio-economic progress, decent job opportunities for labourers in provinces with high ICT

levels have expanded substantially. In 2020, even though the epidemic situation is complicated and many socio-economic activities are restricted due to the epidemic blockade, the likelihood of finding a decent job in a province with a medium or high ICT level stays higher than in 2019.

Table 4 - Results of analysis of the impact of vocational education and training on decent job opportunities regarding ICT

Variables	Description	General Decent job	Low ICT Decent job	Medium ICT Decent job	High ICT Decent job
2.gender	Female, dummy variable	0.204***	0.180***	0.289***	0.151***
		(0.000436)	(0.000577)	(0.000854)	(0.00109)
Index	Information and communications technology Index	0.638***	-0.0930***	3.309***	0.389***
		(0.00179)	(0.00355)	(0.0130)	(0.0105)
skill2	Vocational training and mid-term professional training, dummy variable	1.319***	1.236***	1.338***	1.565***
		(0.000656)	(0.000858)	(0.00135)	(0.00160)
skill3	College, university and higher, dummy variable	2.729***	2.592***	2.848***	2.955***
		(0.000618)	(0.000789)	(0.00132)	(0.00156)
age	Age of laborer	0.0759***	0.0630***	0.0815***	0.105***
		(0.000124)	(0.000164)	(0.000244)	(0.000313)
age2	Age square of laborer	-0.00144***	-0.00130***	-0.00154***	-0.00170***
		(1.57e-06)	(2.06e-06)	(3.09e-06)	(3.95e-06)
married	Married status, dummy variable	0.0414***	0.0416***	0.0361***	0.0349***
		(0.000592)	(0.000778)	(0.00116)	(0.00151)
urban	Urban areas, dummy variable	0.286***	0.367***	0.250***	0.179***
		(0.000459)	(0.000613)	(0.000933)	(0.00114)
2.region	Northern Midlands and Mountains	-0.280***	-0.361***	-0.201***	-0.878***
		(0.000816)	(0.00196)	(0.00137)	(0.00207)
3.vung	North and South Central Coast	-0.513***	-0.453***	-0.538***	-0.900***
		(0.000629)	(0.000891)	(0.00119)	(0.00184)
4. region	Central Highlands	-0.568***	-0.668***	-0.553***	-0.918***
		(0.00131)	(0.00260)	(0.00227)	(0.00263)
5. region	Southeast	0.434***	0.377***	0.667***	-0.259***
		(0.000580)	(0.000670)	(0.00149)	(0.00300)
6. region	Mekong River Delta	-0.510***	-0.354***	-0.461***	-1.092***
		(0.000691)	(0.00107)	(0.00126)	(0.00192)
2.branch	Fishery	-0.00380	0.147***	0.121***	-0.280***
		(0.00463)	(0.00693)	(0.00847)	(0.00933)
3.branch	Mining and quarrying	4.579***	4.629***	4.450***	4.396***
		(0.00278)	(0.00393)	(0.00571)	(0.00601)
4.branch	Manufacturing	4.685***	4.464***	4.915***	4.627***
		(0.00134)	(0.00211)	(0.00243)	(0.00253)
5.branch	Production and distribution of electricity, gas, steam, and water	4.704***	4.565***	4.815***	4.634***
		(0.00308)	(0.00414)	(0.00623)	(0.00741)
6.branch	Construction	1.972***	1.981***	1.851***	1.808***
		(0.00156)	(0.00234)	(0.00296)	(0.00327)
7.branch	Wholesale and retail	1.869***	1.892***	1.625***	1.601***

	Trade	(0.00144)	(0.00221)	(0.00276)	(0.00297)
8.branch	Hotels and restaurant	1.701***	1.656***	1.654***	1.366***
		(0.00171)	(0.00245)	(0.00346)	(0.00422)
9.branch	Transport, storage, information and communication	2.831***	2.793***	2.755***	2.695***
		(0.00155)	(0.00233)	(0.00298)	(0.00321)
10.branch	Other services	3.595***	3.313***	3.771***	3.859***
		(0.00139)	(0.00217)	(0.00256)	(0.00264)
2017.year	Year of 2017, dummy variable	0.0689***	0.0719***	0.0325***	0.142***
		(0.000808)	(0.00104)	(0.00172)	(0.00221)
2018.year	Year of 2018, dummy variable	0.105***	0.0311***	0.250***	0.229***
		(0.000669)	(0.000877)	(0.00138)	(0.00190)
2019.year	Year of 2019, dummy variable	0.151***	0.0680***	0.165***	0.203***
		(0.000661)	(0.000887)	(0.00137)	(0.00178)
2020.year	Year of 2020, dummy variable	0.0450***	-0.118***	0.222***	0.228***
		(0.000662)	(0.000884)	(0.00141)	(0.00172)
Constant		-5.887***	-4.963***	-7.358***	-6.169***
		(0.00273)	(0.00410)	(0.00761)	(0.00732)
Observations		2,276,092	803,738	660,520	811,834

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.   Conclusion and Policy Implications

On the basis of the facts of decent jobs in Vietnam and the decent job rates by ICT index levels, this research demonstrated that, despite improvements, decent job rates remained very low. The higher the technical qualification attainment regarding the ICT index level, the higher the rate of decent jobs. The decent job rates also differed across males and females, industries, areas, regions, and sectors.

According to estimation results, vocationally trained labourers bring higher decent job opportunities than non-vocational-trained labourers. In addition, ICT growth also has influenced decent job possibilities for employees. Therefore, it is essential to assist labourers in enhancing their capabilities and ICT skills for enhanced job search and performance.

ICT has contributed to the evolution of employment services, including online counselling, support services, and easy access to information on labour markets. There is enormous potential for the continuous development of these services, but employees must possess digital literacy in order to benefit from ICT-enabled job search tools and working formats.

The level of vocational education and training was determined to be a significant determinant of decent job chances. In an atmosphere of ICT growth, every working group in society will have access to excellent employment prospects.

The goal of vocational education development in Vietnam by 2030 is to meet the increasing requirements for the quantity, structure, and quality of skilled human resources for national development, in which the proportion of labourers with information and communication technology skills reaches 90%. To achieve the goal, the state must continue to improve institutions, enhance the effectiveness and efficiency of state management of vocational education, and integrate information technology into vocational education development. An emphasis is placed on improving technical infrastructure through investment, expanding telecommunications networks, establishing high-speed broadband access networks, and developing mobile and internet customers.

In addition, the state must strengthen its information technology human resources by increasing its investment in smart education, building an online training system, digitizing programs, textbooks, learning materials, electronic lectures, and simulation lectures, constructing a shared electronic library, and refining the databases of digital learning materials.

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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Conflict of interest

All authors declare that they have no conflict of interest.

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