The Impact of Information and Communication Technology on Decent Employment Opportunities in Vietnam

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Abstract: This paper uses the General Statistics Office (GSO) labour force survey data and the information and communication technology (ICT) index to study the decent job of employees in the context of ICT development towards green growth in Vietnam. The results of the logit model show that the decent job rate is still low, only about 27.7% in 2019. The paper proves that the development of ICT has a positive impact on employment opportunities. This impact is not only sustainable but also affects the group of workers who do not have certificates and workers in urban and rural areas. The higher ICT levels the workers have, the higher chances they get a decent job, including old-aged workers. These findings suggest that a job transition from precarious jobs to more sustainable jobs needs to play a huge role in ICT, so workers, managers and businesses themselves need to promote the development and application of ICT to serve administration, production and business activities and increase skills in applying IT in job search and the work of employees.

Keywords: Decent job, ICT, impact.

1. INTRODUCTION

There is a growing concern that the inflows of investment on digital technology are attributed to job loss, late payment and increased inequality in salary. Historically, it is noteworthy that significant technological innovations were always accompanied by far-reaching transformations in the labour market. As labour productivity increased thanks to innovations, more goods and services could be produced with less labour, thus resulting in technological unemployment. However, information technology (IT) brought new job opportunities to different industries and newly created markets. Based on the economic history, after an interval, the economies would continue to create enough jobs for their workforce, although it is believed that digital technology might replace more employees than any preceding technologies.

In a changeable and unstable economy, risks and instability are prominent characteristics that impact labour supply and demand. The labour market is affected by factors such as technological progress, globalisation, product market changes, population ageing, which questions the term "job for life". According to Hoyos et al. (2013)[1], career change is no longer a one-time event at the beginning of an individual's career but a more complex phenomenon that might, and often, last for a lifetime (Wilson, 2009)[2]. Many changes are made between education and work or between industries and fields. For these changes to be successful, a number of employability skills need to be developed and enhanced. Job changes and labour demand changes should be analysed to find out the reasons why individuals might experience some changes throughout their life.

The deployment and adoption of ICT has facilitated new ways of working, organizing and managing work. As advocated by some researchers, there might be a shift from an industrial to an information society to facilitate globalisation and deploy information and communication technology (ICT). Information society can be characterised by a highly skilled and knowledgeable workforce working in better organisations. This change was argued to mark the shift to "flexible work" (Bimrose, 2006)[3]. A move toward high productivity and skill development was observed in Felstead et al. (2011)[4].

In addition, the adoption of ICT in organisations has facilitated this change, which is illustrated via high productivity thanks to new ways for communicating and organising work. ICT is also considered supportive of new ways of working. According to Autor et al. (2006)[5], ICT was key to new ways of working through enabling communications, stimulating innovation and supporting new products and services. Actual and projected changes towards more highly skilled occupations marked "professionalisation of the workforce" (McCollum, 2012[6]; Wilson, 2009[2]) and there was a growing "polarisation" in the labour market (David et al., 2011)[7]. It was argued by Autor et al. (2003)[8] and Clark, C. (2006)[9] that ICT was partly responsible for labour market polarisation, while others emphasised that ICT was more related to work accomplishment. Thanks to the deployment and adoption of ICT in the labour market, new ways of working are also created, which are liable to generate labour demand across Europe in the next 20-30 years. ICT enables remote work and collaboration with other workers. Such work restructuring gives disadvantaged workers opportuni-

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ties to engage in the labour market, provides flexibility and increases productivity. The benefits of remote working for employers and employees in Belgium were reviewed by Illegems and Verbeke (2004)[10]. Remote working had no negative impact on large-scale human resource activities, as workers were more likely to remain with the company. Companies that adopted it were more likely to retain knowledge and skills, but opportunities for advancement, training, professional interactions, and teamwork were reduced for workers. It was argued by Michailakis (2001)[11] that ICT can help individuals overcome and remove barriers to entry in the labour market, but it is only a partial solution. Individual characteristics and socio-economic contexts should be considered in order to increase employability. Moreover, disadvantaged workers are offered opportunities with new technology, yet available forms of work are limited.

Technology enables new ways of working that have largely been proven beneficial and gives those with fewer work opportunities access to employment opportunities despite their disadvantages in terms of age, health, disability, education or position. Toboso (2010)[12] used the capability approach and focused on ICT adoption for promoting equality and opportunity. In that study, ICT was suggested to play an essential role in the lives of disadvantaged people. Raja et al. (2013)[13] confirmed the contribution of information and communications technology in creating new ICT jobs and promoting an inclusive, innovative, flexible, and transparent market. This paper marked the first step towards the World Bank's efforts to find out how ICT is shaping, changing and transforming labour markets. As its implication, governments and other stakeholders were suggested many methods to boost job opportunities based on ICT development. The impact of information and communication technology on job opportunities was also introduced by Bernhard Dachs (2018)[14]. Both positive and negative effects were approached. Accordingly, workers tend to have high levels of ICT knowledge and expertise to meet the requirements for the jobs. On the other hand, high requirements mean more significant difficulties and challenges to the workers. Unqualified workers will be gradually eliminated and dismissed. Same as Bernhard Dachs (2018), Elvis Melia (2019)[15] evaluated opportunities and threats to jobs posed by the ICT development. Thanks to ICT, automation is enabled on an unprecedented scale, making millions of daily jobs redundant and facilitating new jobs. Therefore, policymakers need to be aware of opportunities and threats from digital innovations to boost positive effects while maintaining a legal framework to minimize adverse effects.

In the context of implementing a national green growth strategy for 2021 - 2030, promoting ICT integration in every aspect of our society is essential to boosting labour productivity. Jobs generated by a green economy are called green jobs, which are sustainable and promoting environmental protection or causing no environmental harm. This paper discusses decent jobs, which is one of the elements for green jobs, in the context of ICT development to evaluate the decent employment opportunities of workers in general, as well as of each labour group according to their qualifications.

2. METHODOLOGY AND DATA

Research Model

In this paper, a probability regression model with a binary variable was applied to analyse the impact of ICT on employment opportunities, in which the binary variable equals 1, indicating the worker has a decent job, or 0, indicating lack of a decent job, as per the approach of several authors (Cem Bas Levent and Ozlem Onaran, 2004)[16]. A logit probability regression model was applied with a binomial variable as a dependent variable, which represents employment status (PROB.Emp). PROB.Emp equals 1, indicating a decent job, or 0, indicating unemployment or lack of a decent job.

Model for employment status:

$y^* = \beta x + \gamma w + u$

$y = 1$ if $y^* > 0$; $y = 0$ otherwise;

x is vectors representing socio-demographic characteristics such as age, gender, education level, marital status. Age and education level variables are used as control variables to identify the impact of salary or other factors on decent employment opportunities. w is macro variables containing provincial information. It is used to measure the impact of inter-provincial differences in ICT levels on decent employment opportunities. ICT variables are based on the aggregation index for 63 provinces in 2016 - 2019.

Basically, the logit model is illustrated as follows:

$$Ln\left(\frac{P_i}{1-P_i}\right) = Z_i$$

$Zi = \beta 0 + \beta 1 ageij + \beta 2 ageij2 + \beta 3 ICTj + \beta 4 Marriedij + \beta 5 Genderij + \beta 6 TTNTij + \beta 7 FDIij + \beta 8 Stateij + \beta 9 branchij + \beta 10 occupij + \beta 11 year + eij$

With variables as explained above, i represents worker i, while is refers to worker i in province s.

age and age2 are respectively age and age squared of the employee, which is the proxy for the experience variable.

ICT is determined by three key criteria including technical infrastructure, human resources infrastructure, and IT applications.

Gender: Gender dummy variable (receiving the value of 1, indicating male, or 0, indicating female)

The following control variables are suggested: Dummy variable TTNT (taking the value of 1, indicating rural areas, or 0, indicating urban areas) for differentiating decent work opportunities in rural and urban labour; dummy variables foreign ownership and state ownership to analyse differences in decent work opportunities by type of ownership; dummy variable branch is also included to control industry elements. The variable Year is included as control macro factors.

CMKT are dummy variables for vocational training levels and higher education levels. It was believed that the higher human capital is revealed through educational levels, the greater the rate of return is (Heckman, 1999[17]; Lynch and Black, 1992[18] or Blundell et al., 1999[19]).

β coefficients of the Logit model are estimated by Maximum Likelihood Estimation instead of Ordinary Least Square. The marginal effect of the independent variable X on the probability that the dependent variable receives the value of 1 is as follows:

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

As per the above formula, the marginal effect of the variable X depends on the estimated coefficients β and the probability value p, usually at the average values of independent variables.

Data

The data set consists of annual labour force survey data from 2016 to 2019 from the General Statistics Office and the corresponding ICT index for 63 provinces from the Ministry of Information and Communications. [20]–[24]

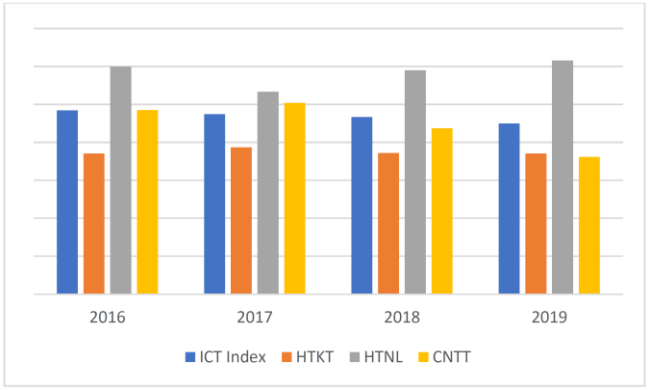
ICT data for 63 provinces in 2016 - 2019 are paired with the corresponding labour force survey data. The labour force survey data include information about the workers, their job and salary. ICT data of 63 provinces provide information on Technical Infrastructure Index, Human Resource Infrastructure Index, ICT application index and the composite index that reflects the level of readiness for ICT application and development (ICT Index).

To examine the relationship between ICT development and decent employment rates, the local ICT-Index is classified into 3 levels. Level 1 consists of 21 provinces with the highest ICT index, level 2 consists of 21 provinces with the medium ICT index and level 3 consists of 21 provinces with the lowest ICT index.

3. RESULTS AND DISCUSSION

In 2016 - 2019, the Human Resource Infrastructure Index improved, but the Technical Infrastructure Index and ICT Application Index remained unchanged and even declined. As a result, the composite index for ICT application and development readiness was basically unchanged.

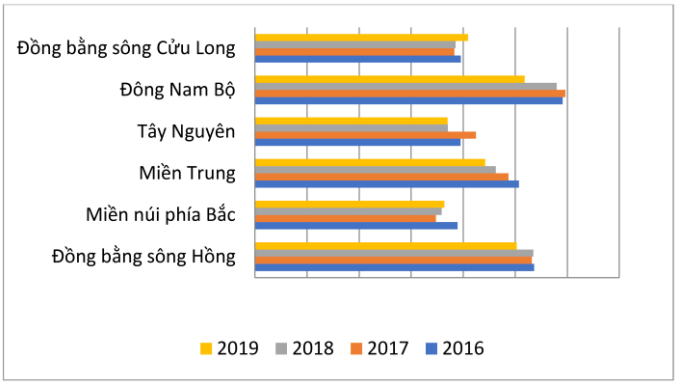
Fig. (1). ICT Index and Component Indices.



Source: Calculated by the authors based on the provincial ICT data

By economic regions: The highest levels of ICT application and development readiness were observed in the provinces of the Southeast, followed by the Red River Delta.

Fig. (2). ICT Index in 6 economic regions.



Source: Calculated by the authors based on the provincial ICT data

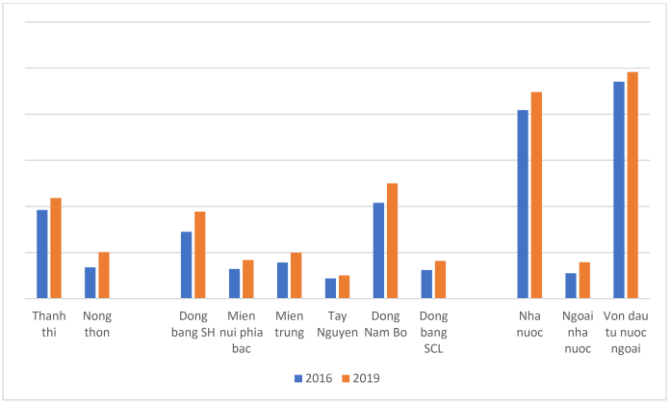
Decent Employment and ICT

Table **1** shows that the decent employment rate increased from 21.5% in 2016 to 27.7% by 2019, indicating that employment quality was improved. In addition, the decent employment rates were higher at places with a higher ICT Index and improved in all ICT levels. In 2016, the decent employment rate was 10% with low ICT level, 17.4% with medium ICT level and 30% with high ICT level; by 2019, these rates were 18%, 22.7% and 38.1%, respectively.

Decent employment rates were improved in all areas and regions in 2016 - 2019. The rates in urban areas were always higher than those in rural areas; the highest rate (50.1%) was observed in the Southeast and the lowest (10.1%) in the Central Highlands.

The decent employment rates in the FDI sector and the State sector were very high, while the rate of non-state sector are very low.

Fig. (3). Decent employment rates by areas and sectors



Source: Calculated from the labour force survey data in 2016 - 2019 from the General Statistics Office

By Qualifications

Qualifications were proportional to decent employment rates. To be specific, the higher qualifications, the higher the decent employment rates. In 2019, the decent employment rate was 16.7% in the unqualified group, 34.5% in the primary

vocational training group, 51.8% in the intermediate vocational training group, 67% in the college group and 82.7% in the university group. Higher decent employment rates were found in qualification groups with a high ICT level; thus, ICT levels and decent employment rates positively correlated in each qualification group.

By gender: The decent employment rates for women were always higher than those for men in 2016 - 2019 at each ICT level. In 2019, this rate was 25.2% for men and 30.5% for women. Table **1** also shows that ICT levels and decent employment rates were correlated.

By age group: The decent employment rates were high for the young-age group and declined gradually with increasing age. In 2019, the rate for workers under 35 was 40.8%. It fell to 24.7% for workers aged 35 - 54 and 5.4% for workers over 55.

Table 1. Decent employment rates by ICT levels.

Unit: %

ICT Index Level	2016				2019			
	High	Medium	Low	Average	High	Medium	Low	Average
General	30.0	17.4	10.0	21.5	38.1	22.7	18.0	27.7
Qualification								
Unqualified	17.1	9.1	3.0	10.9	24.1	15.0	8.9	16.7
Primary vocational training	41.6	28.1	20.2	35.1	41.0	27.9	27.3	34.5
Intermediate vocational training	51.6	43.7	39.2	47.1	60.6	45.1	43.5	51.8
College	66.4	61.8	51.9	62.6	71.3	64.2	58.8	67.0
University	83.0	79.6	78.0	81.6	83.6	80.3	82.7	82.7
Gender								
Male	28.6	16.6	9.6	20.4	35.8	19.6	16.0	25.2
Female	31.3	18.3	10.4	22.6	40.7	26.2	20.3	30.5
Age group								
Young workers, under 35	43.6	29.5	12.9	32.2	53.6	35.2	26.6	40.8
Middle-aged workers, aged 35-54	25.8	14.6	10.3	18.8	33.5	19.9	17.1	24.7
Workers aged over 55	7.3	3.2	2.2	4.7	8.9	3.7	3.4	5.4

Source: Calculated from the labour force survey data in 2016 - 2019 from the General Statistics Office

Table 2. Decent employment rates by industries and ICT levels.

Unit: %

ICT Index Level	2016				2019			
	High	Medium	Low	Average	High	Medium	Low	Average
Agriculture, forestry	0.7	0.9	0.3	0.6	1.2	0.7	0.6	0.8
Fishing	0.9	2.0	0.2	0.8	2.1	0.5	0.4	0.8
Mining Industry	71.7	41.6	41.6	61.1	78.4	39.1	50.8	66.0
Manufacturing Industry	61.3	49.2	30.8	54.3	67.3	65.0	54.5	64.3
Electricity, gas, steam and water supply	64.7	75.4	47.4	65.0	67.4	60.9	58.5	64.7
Construction	16.1	7.4	5.7	11.4	17.4	5.8	7.0	10.6
Trade	19.0	6.6	4.7	12.9	24.2	8.8	9.7	16.6
Hotels and restaurants	11.5	8.2	2.7	8.9	15.8	4.5	7.1	10.9

Transport, storage and communications	46.9	28.4	17.5	37.7	45.8	25.1	36.0	38.7
Other service activities	61.6	56.9	59.4	60.1	65.1	62.5	64.3	64.2

Source: Calculated from the labour force survey data in 2016 - 2019 from the General Statistics Office.

In terms of industries, the decent employment rate was very low in Agriculture, Forestry and Fishing, accounting for 0.8%, higher in Mining Industry (66%) and Manufacturing Industry (64.3%) or Service. Generally, workers in places with high ICT levels had better decent employment rates in the same industry.

Estimated results of the above model are shown in Table **3** below with some key findings:

Initially, there was evidence that ICT had a positive impact on overall decent employment opportunities and on all qualification groups (the estimated coefficients are all different from 0, statistically significant).

For qualified groups, the impact at the primary vocational training level was most insignificant, and then the estimated coefficients declined gradually at college and university levels. This situation corresponds to the decent employment rates by qualifications, as the rates were generally higher for groups with higher qualifications. Therefore, the margin effects would typically decline. Thus, to boost decent employment opportunities, workers are required to improve their own skills and qualifications to take better advantage of ICT development.

Additional factors such as age, gender, marital status of workers were also included to control the impact of individual characteristics on decent employment opportunities.

Geographical features such as urban, rural areas and economic regions were included to reflect the variation of decent employment rates in regions with different levels of economic development.

Industries and sectors were added to examine if decent employment rates were affected by industries and sectors.

Time was included to control macro variables with potential impact but not observed in this model.

Table 3. Model Estimation Results: Impact of ICT Decent Employment Opportunities.

Variable	Description	Unqualified	Primary Vocational Training	Intermediate Vocational Training	College	University and Above
ICT-Index	ICT Index	0.999***	1.451***	1.070***	0.954***	0.755***
		(0.00314)	(0.00789)	(0.00691)	(0.00830)	(0.00641)
age	Age	0.0551***	0.0753***	0.161***	0.195***	0.237***
		(0.000204)	(0.000649)	(0.000545)	(0.000755)	(0.000524)
age2	Age squared	-0.00130***	-0.00133***	-0.00231***	-0.00259***	-0.00303***
		(2.62e-06)	(8.04e-06)	(6.55e-06)	(9.55e-06)	(6.21e-06)
married	Married	-0.0255***	-0.0808***	-0.201***	-0.239***	-0.275***
		(0.00104)	(0.00294)	(0.00254)	(0.00276)	(0.00222)
2.vung	Northwest	-0.441***	-0.551***	-0.230***	-0.0989***	-0.285***
		(0.00161)	(0.00385)	(0.00294)	(0.00379)	(0.00327)
3.vung	Central	-0.219***	-0.387***	-0.301***	-0.265***	-0.409***
		(0.00112)	(0.00268)	(0.00233)	(0.00276)	(0.00220)
4.vung	Central Highlands	-0.662***	-0.746***	-0.279***	-0.126***	-0.347***
		(0.00260)	(0.00589)	(0.00440)	(0.00570)	(0.00424)
5.vung	Southeast	0.340***	-0.0685***	0.0310***	0.0415***	-0.284***
		(0.00103)	(0.00256)	(0.00254)	(0.00303)	(0.00204)
6.vung	Mekong River Delta	-0.429***	-0.738***	-0.374***	-0.233***	-0.328***
		(0.00118)	(0.00356)	(0.00295)	(0.00380)	(0.00283)
ttnt1	Urban areas	0.324***	0.669***	0.497***	0.220***	0.248***

		(0.000817)	(0.00203)	(0.00177)	(0.00220)	(0.00176)
2.gender	Female	-0.0781***	0.106***	-0.103***	0.0639***	-0.00723***
		(0.000763)	(0.00329)	(0.00183)	(0.00219)	(0.00159)
2.branch	Fishing	-0.483***	-1.095***	0.372***	0.575***	0.188***
		(0.00656)	(0.0257)	(0.0189)	(0.0295)	(0.0176)
3.branch	Mining Industry	3.871***	2.581***	3.400***	3.882***	2.184***
		(0.00457)	(0.0130)	(0.0131)	(0.0219)	(0.0159)
4.branch	Manufacturing Industry	4.635***	2.488***	2.694***	3.158***	1.803***
		(0.00251)	(0.00963)	(0.00604)	(0.00913)	(0.00692)
5.branch	Electricity, gas, steam and water supply	4.469***	2.337***	3.357***	3.395***	2.052***
		(0.00492)	(0.0173)	(0.0149)	(0.0220)	(0.0149)
6.branch	Construction	2.072***	1.335***	1.440***	1.776***	1.179***
		(0.00288)	(0.00996)	(0.00655)	(0.00974)	(0.00709)
7.branch	Trade	2.300***	1.126***	1.257***	1.945***	0.859***
		(0.00279)	(0.00966)	(0.00617)	(0.00920)	(0.00678)
8.branch	Hotels and restaurants	2.237***	1.650***	1.189***	1.660***	0.480***
		(0.00306)	(0.0111)	(0.00696)	(0.00995)	(0.00750)
9.branch	Transport, storage and communications	2.510***	0.426***	1.371***	2.078***	1.384***
		(0.00305)	(0.00949)	(0.00638)	(0.00954)	(0.00712)
10.branch	Other service activities	2.688***	0.985***	1.081***	1.482***	0.991***
		(0.00281)	(0.00981)	(0.00591)	(0.00903)	(0.00661)
occup_91	Officials and managers	0.186***	-0.595***	0.845***	0.641***	1.515***
		(0.00747)	(0.0151)	(0.00620)	(0.00906)	(0.00669)
occup_92	Professionals	1.387***	1.007***	1.812***	2.528***	3.109***
		(0.0109)	(0.0153)	(0.00692)	(0.00702)	(0.00646)
occup_93	Technicians and associate professionals	0.0446***	0.742***	1.767***	2.137***	2.287***
		(0.00441)	(0.00888)	(0.00479)	(0.00652)	(0.00719)
occup_94	Clerical support workers	1.045***	0.371***	1.562***	2.007***	2.359***
		(0.00235)	(0.00748)	(0.00543)	(0.00747)	(0.00714)
occup_95	Service and sales workers	0.174***	-0.148***	0.379***	0.364***	0.786***
		(0.00151)	(0.00708)	(0.00500)	(0.00678)	(0.00670)
occup_96	Skilled agricultural, forestry and fishery workers	1.110***	0.467***	-0.636***	-0.263***	-0.449***
		(0.00315)	(0.0143)	(0.0148)	(0.0204)	(0.0159)
occup_97	Craft and related trades workers	-0.549***	-0.387***	-0.0379***	0.385***	0.587***
		(0.00121)	(0.00690)	(0.00506)	(0.00689)	(0.00743)
occup_98	Plant and machine operators, and assemblers	1.232***	1.511***	1.370***	1.417***	1.509***
		(0.00129)	(0.00643)	(0.00511)	(0.00710)	(0.00769)
2.LHDN2	Non-state enterprises	-2.849***	-2.499***	-2.093***	-1.648***	-2.001***

		(0.00176)	(0.00403)	(0.00245)	(0.00310)	(0.00218)
3.LHDN2	FDI enterprises	0.636***	0.531***	1.055***	0.946***	0.837***
		(0.00262)	(0.00992)	(0.00838)	(0.00842)	(0.00772)
2017.year	2017	0.0611***	-0.152***	-0.227***	-0.121***	-0.185***
		(0.00132)	(0.00361)	(0.00304)	(0.00347)	(0.00271)
2018.year	2018	0.298***	-0.172***	0.00965***	-0.00409	0.0762***
		(0.00105)	(0.00278)	(0.00230)	(0.00289)	(0.00215)
2019.year	2019	0.503***	0.0419***	0.396***	0.400***	0.318***
		(0.00103)	(0.00269)	(0.00238)	(0.00294)	(0.00215)
Constant	Constant	-3.283***	-2.044***	-4.019***	-5.485***	-5.151***
		(0.00475)	(0.0156)	(0.0123)	(0.0166)	(0.0126)
Observations						
R-squared		1414364	64.458	103.241	64.500	191.788
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

4. DISCUSSION AND POLICY IMPLICATIONS

Based on the realities of decent employment in Vietnam and the decent employment rates by ICT levels, this paper showed that though improved, the decent employment rates were still quite low. The higher ICT levels, the higher the decent employment rates. The decent employment rates also varied between male and female, young and older labour groups, between industries, between types of ownership, between areas and regions.

According to estimation results, ICT development positively impacted decent employment opportunities for workers of all qualifications from no qualifications, primary vocational training, and intermediate vocational training to college and university. Hence, it is important to support workers in improving personal capability and ICT skills for better job search and job performance.

ICT has also contributed to transforming employment services, for instance, online advisory and support services and easy access to information on the labour market. There is remarkable potential for further development of these services, but to benefit from ICT-enabled job search tools and working forms, workers need to have digital knowledge.

ICT facilitates a more accessible and more economical connection between recruiters and job seekers. Therefore, workers are recommended to equip minimal ICT skills to gain access to social services and enterprises to promote ICT deployment in recruitment and manufacturing to create job opportunities for every individual in society.

There are still short- and medium-term work for computer-literate old workers, which allows old workers to extend their working life past retirement age in the context of population ageing in Vietnam. Not only professional skills but also ICT basic skills are necessary for older workers to continue working.

The education level was identified as a relevant variable for decent employment opportunities. In an environment of ICT development, decent employment opportunities will be available for every working group in society.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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