Factors Affecting Labor Quality in Industrial Enterprises in Vietnam in Industry 4.0: The Case in Thai Nguyen Province

Phung Tran My Hanh[1], Nguyen Thi Dung[2,*], Nguyen Tien Long[3], Do Thi Hoa Nha[4], Nguyen Viet Phương[5] and Nguyen Thi Oanh[6]

[1,3,4,5,6] *Thai Nguyen University of Economics and Business Administration (TUEBA), Vietnam.*

[2]*Bac Giang University of Agriculture and Forestry.*

Abstract: This paper analyses the factors affecting labor quality in Industrial enterprises in Vietnam in Industry 4.0 measured by Exploratory factor analysis (EFA) and Multivariate Regression Analysis, using data collected from 176 samples in Thai Nguyen Industrial enterprises, Vietnam. The research deals with designing the research hypothesis, and determining factors affecting labor quality. After determining the appropriate factors to examine the impact on Thai Nguyen labor quality in Industrial enterprises in Vietnam, the necessary tests to detect multicollinearity, and t-tests are performed. The analysis results show that 5 factors have a positive relationship with Labor quality in Industrial enterprises in Industry 4.0; Policy to support the labor of the State and the province; System of training and vocational training institutions of the province; Development of science and technology; Strategy to improve labor quality of Industrial enterprises; and Individual capacity of labor. From the research findings, the study provides recommendations for Industrial enterprises in Vietnam in Industry 4.0.

Keywords: Labor, labor quality, science and technology, Industrial enterprises, Industry 4.0.
JEL Classification: J01, J21, O14.

1. INTRODUCTION

Industry 4.0 (The Industrial revolution 4.0) is developing with an extremely large scope and complexity, requiring countries to be more proactive in the context of drastic changes in the era of smart industry and modern technology. In this revolution, all areas of socio-economic life are affected, especially Industrial enterprises - where many labors and jobs are used. The development of automatic technology will help liberate human labor, and increase labor productivity, but also push millions of people to face the risk of losing their jobs. Industry 4.0 will also lead to the trend that countries with technological and capital advantages will return to invest in their countries on the basis of applying "smart factory" technology, rather than investing in a country that has the advantage of labor resources. This is a big challenge, especially for Vietnam, which has a large workforce of unskilled workers. So, this requires that Vietnam have a strategic vision to carry out the transformation of thinking about careers, contract systems, and labor relations for employees.

Thai Nguyen is a Northern midland and mountainous province in Vietnam, with many Industrial enterprises making a significant contribution to developing the socio-economic in Thai Nguyen province, Vietnam. The number of Industrial enterprises accounted for 24.37% of total enterprises with 156,776 labors in Thai Nguyen province with many limitations such as small scale, up to 50.06% of super-sized enterprises, small with the capital of only 1-5 billion VND/enterprise in the Industrial Revolution 4.0. Thai Nguyen labor is growing rapidly. The education and professional qualifications of labors are increasingly improved. The number of workers with knowledge and mastery of advanced science and technology has increased. Labors in industrial enterprises and non-state-owned and foreign-invested enterprises have also improved in skills, labor skills, industrial style, and advanced working methods.

However, before the requirements of development, employees still have many limitations and inadequacies such as not meeting the requirements of quality, structure, and educational, professional and professional skills of the career. industrialization, modernization and international economic integration; serious shortage of technical experts, good managers, and skilled workers; industrial manners and labor discipline are still limited; the majority of laborers are farmers, who have not received basic and systematic training. Besides, the cultural level and skills of workers, although improved, are still low, which significantly affects the acquisition of science and technology, labor productivity, and quality product. These previous types of research have empirically investigated factors that impact labor quality in the enterprise such as Hill & Stewart (1999), Jameson (2000), Li & Chris (2008), Nguyen (2015), and Kruger (2018). These studies have been tested and used widely for analyzing labor quality factors, appropriate adjustments may be required when they are applied to Industrial enterprises in Vietnam in Industry 4.0 context.

*Address correspondence to this author at the Bac Giang Agriculture and Forestry University (BAFU); Email: nguyendungktkt81@gmail.com

Table 1. Description of Independent Variables.

No.	Factors	Source
1	Policy to support the labor of the State and the province	Hill and Stewart (1999); Li & Chris (2008); Nguyen (2014); Nguyen (2015); Nguyen (2017)
2	System of training and vocational training institutions of the province	Hill and Stewart (1999); Bui (2015); Nguyen (2015); Nguyen (2017)
3	Development of science and technology	Kruger (2008); Nguyen (2015); Nguyen (2017)
4	Strategy to improve labor quality of Industrial enterprises	Hill & Stewart (1999); Jameson (2000) Nguyen (2015); Nguyen (2017);

Source: Author's summary.

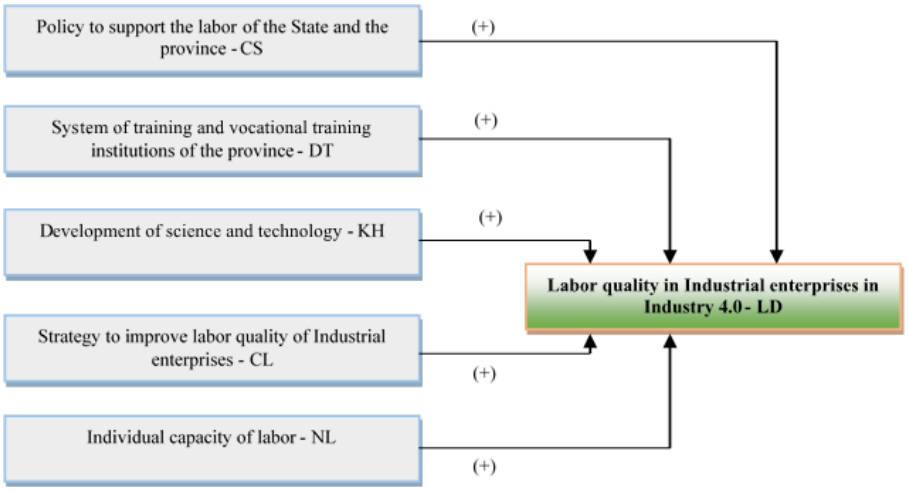

Fig. (1). Conceptual framework.
Source: Author's synthesis from studies and Author's review.

This article investigates factors affecting labor quality in Industry enterprises in Vietnam in Industry 4.0 measured by Exploratory factor analysis (EFA) and Multivariate Regression Analysis with 31 measurement variables and 176 samples. From the result findings, several recommendations that help Industrial enterprises to improve labor quality in Industry 4.0 are provided.

2. LITERATURE REVIEW

There are extensive researches on the factors affecting labor quality. In general, these studies point to a small but positive effect on labor quality in enterprises (Cope and Watts, 2000; David, 2000; David and Steven, 2003; Janice, 2004; Alan, 2006; Aynur et al (2016); Hoang & Nguyen (2020)). Three main activities for improving labor quality include education, training, and development. Training related to learning focuses on the current work of the learner. Education is related to learning focusing on the work and future development of learners (Nadler, L. and Nadler, Z., 1989). Investigate factors affecting labor quality in small-scale enterprises are Strategy; Growth; Innovation; Associated with business performance results; Viewpoints of business owners; Culture; Industry factors; Technology; Difficulty recruiting; education; Innovation changes; Expectation; Outside help; Reasonableness of training (Hill and Stewart, 1999).

Many current studies have empirically investigated necessary skills, education, and training activities for labor quality in enterprises, organizations, and countries in the Industrial revolution 4.0. For example, Paul (2016) shows that the Fourth Industrial Revolution constitutes both a risk and an opportunity for European economies. Reskilling is now a central element in the introduction of connected production. However, Kruger (2008) conducted a survey of the existing research on structural change at various levels of aggregation with a special focus on the relation to productivity and technological change. The exposition covers the research concerning the development of the three main sectors of the private economy, multisector growth models, and recent evolutionary theories of structural change., whereas Christian (2017) presented the state of implementation of Industry 4.0; presents typical obstacles and challenges for the Mittelstand; demonstrates the importance of involving employees to improve the success of innovation processes in the company; and derives political recommendations to improve the overall framework. In addition, as IndustriALL Global Union (2017) notes both companies and governments in Europe have engaged in strategic skills planning and taken measures to make industrial jobs more appealing. Some remarks on skills and the regional divide, product complexity, and skill level are important indicators for the economic development of Industry 4.0. These were followed by a number of further studies such that of KPMG (2016), International Labour Organization (2016), Benešová and Tupa (2017), Gerlind et al (2017), Silvio et al (2017), Oscar Lazaro (2017), Jan et al (2017) and Daniel (2017).

Fig. (**1**) illustrates the impact of factors affecting labor quality in Thai Nguyen Industrial enterprises in Industry 4.0.

3. METHODOLOGY

3.1. Definition of Variables

The number of Industrial enterprises includes 4 kinds of enterprises as Mining and quarrying enterprise; Manufacturing enterprise *(Manufacture of food products and manufacture of beverages, Manufacture of textiles, Manufacture of leather and related products...);* Electricity, gas, steam, and air conditioning supply enterprise; and Water supply, sewerage, waste management, and remediation activities enterprise). To ensure the number of research samples, the study uses a census with mining industry enterprises (64 enterprises); Electricity, gas, steam, and air conditioning supply enterprise (28 enterprises), and Water supply, sewerage, waste management, and remediation activities enterprises (20 enterprises). For Manufacturing enterprises, the author randomly investigates and selects the sample size according to Slovin's (1960) formula with an error of 10%:

$$n = \frac{N}{1 + N \times e^2} = \frac{807}{1 + 807 \times 0.1^2} \approx 89$$

In there: n = number of samples

N = total samples

e = error margin

Table 2. Number of Survey Samples.

Kind of Industrial Enterprises	Number of Enterprises	Number of Samples
Mining and quarrying enterprise	64	64
Manufacturing enterprise	807	89
Electricity, gas, steam, and air conditioning supply enterprise	28	28
Water supply, sewerage, waste management, and remediation activities enterprise	20	20
Total	919	201

Source: Author's summary.

According to Hair et al (2014) for Exploratory factor analysis (EFA), the minimum sample size is 50, preferably 100, and the number of observations/measurement variables is 5/1, meaning that each measure should be at least 5 observations. With 31 variables in the study, the minimum sample size is 31 x 5 = 155 samples. Therefore, the number of survey samples proposed by the author for each group of respondents has ensured the conditions for the study.

With 31 measurement variables divided into 6 group factors (5 independent factors: CS, DT, KH, CL, NL, and 1 dependent factor: LD) given, the minimum sample size is 155 samples, to eliminate inappropriate votes and still ensure the capacity sample, the study surveyed 201 samples that were allocated to the fields. Out of 201 questionnaire samples, there were some incomplete and inappropriate questionnaires, so when analyzing EFA, the author only selected 181 questionnaires with complete information to include in the model. **31** measurement variables and **176** votes were eligible to conduct EFA.

The Multivariable regression model is very useful to analyze influencing factors, so the study uses a Multivariable regression model to consider 5 factors affecting labor quality in Industrial enterprises in Thai Nguyen province during the Industrial revolution. 4.0.

Normalized regression equation: $LD = \beta_1 CS + \beta_2 DT + \beta_3 KH + \beta_4 CL + \beta_5 NL$

In there: LD = Labor quality in Industrial enterprises in Industry 4.0;

CS = Policy to support the labor of the State and the province;

DT = System of training and vocational training institutions of the province;

KH = Development of science and technology;

CL = Strategy to improve labor quality of Industrial enterprises;

NL = Individual capacity of labor.

The degree of influence of the factors is shown by the coefficients β_1 to β_5 in the multivariable linear regression equation. Independent variables with a larger coefficient b will have a greater influence. Independent variables with coefficient $\beta>0$ will have a positive effect on the dependent variable on energy efficiency, and independent variables with coefficient $\beta<0$ will have a negative effect on the dependent variable on energy efficiency.

3.3. Research Hypothesis

The study tested 5 hypotheses from H1 to H5:

H1: The policy to support the labor of the State and the province has a positive influence on the quality of labor in Industrial enterprises in Thai Nguyen province.

H2: The system of training and vocational training institutions of the province has a positive influence on the quality of labor in Industrial enterprises in Thai Nguyen province.

H3: The development of science and technology has a positive influence on the quality of labor in Industrial enterprises in the Thai Nguyen province

H4: Strategy to improve labor quality of Industrial enterprises positively affects labor quality in Industrial enterprises in Thai Nguyen province

H5: Individual capacity of labor positively affects labor quality in Industrial enterprises in Thai Nguyen province

4. RESEARCH RESULTS

4.1. Cronbach's Alpha Coefficient and Exploratory Factor Analysis Results

The analysis results used SPSS 20.

* Cronbach's Alpha coefficient

The scales of the official research are evaluated through Cronbach's Alpha reliability coefficient. Cronbach's Alpha

Table 3. Results of KMO and Bartlett's Test – Independent Variable.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.788
Bartlett's Test of Sphericity	Approx. Chi-Square	2246.633
	df	378
	Sig.	.000

Source: SPSS 20 analysis's results.

coefficient is used to remove garbage variables, variables with a variable total correlation coefficient less than 0.3 will be excluded and each scale component will be selected if Cronbach's Alpha coefficient is from 0.6 above.

Cronbach's Alpha coefficient of the scales in the research model has the biggest value of 0.899 and the smallest value of 0.787. All Cronbach's Alpha coefficients are greater than 0.6 and the variable-total correlation coefficient is greater than 0.3. Therefore, all 31 observed variables are guaranteed for exploratory factor analysis (EFA) in the next step.

* Exploratory factor analysis (EFA)

- Independent variable

Table **3** shows the KMO coefficient = 0.788 (>0.5) and Barlett's test has significance Sig.=0,000 (<0.05). According to table **4**, Eigenvalues are all greater than 1, satisfactory. The extracted variance is 58.827% (>50%) satisfactory, indicating that 5 factors explain 58.827% of the variation of the research data.

Table 4. EFA for Independent Variable Results.

No.	Component	Observed Variable	Factor					Cronbach's Alpha
			1	2	3	4	5	
1	System of training and vocational training institutions of the province	DT6	.854					.899
2		DT4	.820					
3		DT3	.789					
4		DT2	.783					
5		DT5	.742					
6		DT1	.717					
7	Strategy to improve labor quality of Industrial enterprises	CL7		.762				.833
8		CL4		.746				
9		CL6		.707				
10		CL5		.690				
11		CL2		.682				
12		CL1		.643				
13		CL3		.640				
14	Individual capacity of labor	NL3			.726			.804
15		NL2			.720			
16		NL1			.717			
17		NL4			.672			
18		NL6			.665			
19		NL5			.658			
20	Policy to support the labor of the State and the province	CS2				.862		.884
21		CS3				.851		
22		CS1				.844		

23		CS4				.786		
24	Development of science and technology	KH1					.764	.787
25		KH4					.721	
26		KH2					.709	
27		KH5					.705	
28		KH6					.660	
Initial Eigenvalues			6.728	3.357	2.464	2.299	2.073	
% of Variance			22.422	11.989	8.801	8.210	7.405	
Cumulative (%)			22.422	34.411	43.212	51.422	58.827	

Source: SPSS 20 analysis's results.

Table 5. KMO and Bartlett's Test – Dependent Variable.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.711
Bartlett's Test of Sphericity	Approx. Chi-Square	166.882
	df	3
	Sig.	.000

Source: SPSS 20 analysis's results.

Table 6. EFA for the Dependent Variable Results.

No.	Component	Observed Variable	Factor	Cronbach's Alpha
			1	
29	Labor quality in Industrial enterprises in Industry 4.0	LD3	.855	.804
30		LD1	.855	
31		LD2	.834	
Initial Eigenvalues			2.157	
% of Variance			71.899	
Cumulative (%)			71.899	

Source: SPSS 20 analysis's results.

Table 7. Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.670[a]	.448	.432	.36999	1.793

a. Predictors: (Constant), NL, CL, CS, DT, KH.

b. Dependent Variable: CLLD.

Source: SPSS 20 analysis's results.

- Dependent variable

Table **5** and Table **6** illustrate KMO coefficient = 0.711 (>0.5) and Barlett's test has a significance level of Sig.=0,000 (<0.05), Eigenvalue = 2.157 > 1 satisfactory, 3 observed variables are grouped into 1 factor. The extracted variance is 71.899%.

The results of EFA show that the independent and dependent variables in the research model have both convergent and acceptable discriminant values, and EFA analysis is appropriate for the research data. From the 6 factors of the originally proposed research model with 31 observed variables, after testing the reliability of Cronbach's Alpha and analyzing the EFA factors, 6 factors remained unchanged with 31 observed variables, including 28 observed variables of the 5 independent factors and 3 observed variables of the dependent factor.

Table 8. Multivariate Regression Analysis Results.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.596	.281		2.126	.035		
	CS	.141	.045	.194	3.147	.002	.854	1.171
	DT	.142	.051	.173	2.796	.006	.851	1.175
	KH	.155	.051	.188	3.036	.003	.843	1.187
	CL	.328	.060	.334	5.479	.000	.872	1.147
	NL	.157	.053	.179	2.938	.004	.878	1.139

a. Dependent Variable: LD.

Source: SPSS 20 analysis's results.

4.2. Multivariate Regression Analysis Results

The results of the model for the value $R^2 = 0.448$ show that the independent variable included in the regression affects 44.8% of the change of the remaining dependent variable due to variables outside the model and random error. Durbin - Watson coefficient is 1.793, so no first-order series autocorrelation occurs. F test with significance level Sig= 0.00 < 0.05, thus, the multiple linear regression model fits the data set and can be used.

In the t-test in table 8 with the Sig significance level, the regression coefficients of the independent variables are all less than 0.05, so all the independent variables have significant explanatory significance for the dependent variable, and no variable is excluded from the model. The coefficient of variance exaggeration VIF of the variables in the model is all very small, the value from 1.139 to 1.187 is less than 3, proving that the regression model does not violate the hypothesis of multicollinearity, and the research model has significant statistical meaning.

The analysis is performed by the Enter method, the variables are entered at the same time to select based on the criteria of selecting those variables with a significance level < 0.05. The results of the regression analysis are presented in Table **8**.

Normalized regression equation:

LD = 0.194*CS + 0.173*DT + 0.188*KH+ 0.334*CL + 0.179*NL

The regression equation shows that the labor quality in Industrial enterprises in Industry 4.0 is affected by 5 factors. In particular, the strategy to improve the labor quality in Vietnam's Industrial enterprises is the factor that has the most impact on labor quality. The order of influence of factors CL, CS, KH, NL, DT.

5. CONCLUSION AND RECOMMENDATION

Normalized regression equation demonstrates how the factors affecting labor quality in Vietnam's Industrial enterprises in Industry 4.0. All 5 factors CS, DT, KH, CL, and NL have a positive relationship with labor quality in Industrial enterprises. Specifically, CL is the variable that has the strongest impact on labor quality. When CS increases by 1%, the labor quality in Industrial enterprises increases by 0.194%. DT increases by 1%, and the labor quality in Industrial enterprises increases by 0.173%. KH increases by 1%, and the labor quality in Industrial enterprises increases by 0.188%. CL increases by 1%, and the labor quality in Industrial enterprises increases by 0.334%. As NL increases by 1%, the labor quality in Industrial enterprises increases by 0.179%.

Based on the research results, the following recommendation can be presented:

The Policy to support the labor of the State and the province has a positive relationship with labor quality in Industrial enterprises in the 4.0 industrial revolution. This conclusion is consistent with the research results of Hill & Stewart (1999), Li & Chris (2008), and Nguyen (2015). The Law on Vocational Education, the Employment Law 2013, and the Labor Code 2019 contain incentives and tax incentives for businesses and employers to participate in vocational education, training, and retraining vocational skills training to maintain jobs for labors. Recently, the Government has developed, adjusted, and perfected many policies to support labor quality in Industry 4.0; such as Decision No. 749/QD-TTg with the national digital transformation program to 2025, with orientation to 2030 with many contents of training and developing human resources to meet the digital application process. Decision No. 127/QD-TTg - National strategy on research, development, and application of artificial intelligence to 2030 with full contents and conditions for ministries and branches to successfully implement the target. By 2030, Vietnam is in the group of 4 leading countries in the ASEAN region and the group of 50 leading countries in the world in research, development, and application of artificial intelligence. The Party and Government clearly define the view of fast and sustainable development of the country based mainly on science and technology, innovation, and digital transformation.

The System of training and vocational training institutions of the province has a positive relationship with labor quality in Industrial enterprises in the 4.0 Industrial revolution. The same conclusion can be seen in the works of Hill & Stewart (1999), and Nguyen (2015). Education and training institutions provide a very large number of employees for enter-

prises in general and industrial enterprises in particular. In the academic year 2020-2021, the number of high school graduates is 16,396 students; 7,087 students graduating from the intermediate level; 3,271 students graduating from college, and 9,727 graduating from university (Thai Nguyen Statistics Office, 2021). Therefore, the system of education and training institutions needs to innovate training and education methods to enhance the role of training institutions in order to improve the quality of labor with multidisciplinary knowledge and skills in the field of education in the Industrial revolution 4.0.

Development of science and technology has a positive relationship with labor quality in Industrial enterprises in the 4.0 industrial revolution. This result is the same as the study by Nguyen (2015) and Kruger (2018). In the Industrial Revolution 4.0, Science and technology are developing at a high speed, and tools put into production are more and more modern, requiring workers to have corresponding qualifications to be able to use, and control machine control of the output. Improving the professional culture of people is of great significance to increasing labor productivity. This is an indispensable factor because although science and technology are developing at high speed and putting into production modern tools, it requires labor with corresponding qualifications. Without highly qualified labors, it is impossible to control machines and grasp modern technology.

Strategy to improve the labor quality of Industrial enterprises has a positive relationship with labor quality in Industrial enterprises in Industry 4.0. This is consistent with the research results of Hill & Stewart (1999), Jameson (2000), and Nguyen (2015). Industrial enterprises need to develop a business strategy in parallel with the strategy of improving labor quality; create conditions for employees to study and improve their professional skills; while promoting employees' self-discovery, learning, and self-improvement through online training courses, via the internet and creating learning environment right at the enterprise. In addition, Industrial enterprises need to apply technology in human resource management because it is a way to save time, increase the efficiency of management activities, and promote employees to integrate into a professional working environment.

The individual capacity of labor has a positive relationship with labor quality in Industrial enterprises in Industry 4.0. Labor lacks skills and labor productivity is still low compared to the ASEAN region. Vietnam's labor force is still weak and lacks the basic skills and foundations necessary to adapt in the context of technological change caused by the Fourth Industrial Revolution. Initially trained workers have not met the requirements of the enterprise due to the lack of skills that reality requires at the enterprise. High-value-added, high-tech application industries and economic sectors face challenges due to the lack of highly skilled human resources. In addition, the problem of physical strength, sense of labor discipline, professional ethics, and ability to work in a multicultural environment are also considered weaknesses of Vietnamese workers.

Improve labor capacity, raise Vietnamese labor skills, and contribute to improving productivity, labor efficiency, and national competitiveness. Encourage the spirit of lifelong learning and training to improve the skills and qualifications of employees; honor and affirm the position and importance of skilled workers, especially those with high skills and excellent occupational skills; promote the companionship and cohesion of the State - School - Entrepreneurs and the whole society in developing skills for workers to adapt to the context of Industry 4.0 is necessary.

ACKNOWLEDGMENT

This study was funded by Thai Nguyen University of Economics and Business Administration (TUEBA), Thai Nguyen province, Vietnam, the product of project - title name: "*Factors affecting labor quality of Industrial enterprises in Thai Nguyen province in the Fourth Industrial revolution*", code number ĐH2021-TN08-05.

The authors would like to thank Thai Nguyen University of Economics and Business Administration (TUEBA), Thai Nguyen province, Vietnam for the time and financial support for us to complete this study.

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

REFERENCES

Alan, C. (2006). Manager as learning facilitators in small manufacturing firms, *Journal of Small Business and Enterprise Development*, 13(3), 351-362. https://doi.org/10.1108/14626000610680244.

Aynur K., Serdar U., Turgut A., Bayram E. (2016). Factors Affecting Labor Productivity: Perspectives of Craft Workers, *Procedia Engineering*, 164, 28-34. http://doi: 10.1016/j.proeng.2016.11.588.

Benešová, A., & Tupa, J. (2017). Requirements for Education and Qualification of People in Industry 4.0, *Procedia Manufacturing*, 11, 2195-2202. https://doi.org/10.1016/j.promfg.2017.07.366.

Bui, T.P.T (2015). *Developing human resources for agriculture in Hoa Binh province*, Doctoral thesis of Development Economics, Vietnam Academy of Agriculture, Vietnam.

Christian, S. (2017). The Challenges of Industry 4.0 for Small and Medium-sized enterprises. *A project by the Friedrich-Ebert- Stiftung.*

Cope, J., Watts, G. (2000). Learning by doing - An exploration of experience, critical incidents and reflection in entrepreneurial learning, *International Journal of Entrepreneurial Behavior and Research*, 6(3),104-124. http://doi.org/10.1108/13552550010346208.

Daniel, B. (2017). Social Innovation Policy for Industry 4.0, *A project by the Friedrich-Ebert- Stiftung*.

David, D. & Steven J. (2003). Training and Development Activities in SMEs: Some Findings from an Evaluation of the ESF Objective 4 Programme in Britain, *International Small Business Journal*, 21(2), 213-228. https://doi.org/10.1177/0266242603021002005.

David, R. (2000). Understanding entrepreneurial leaning: a question of how?, *International Journal of Entrepreneurial Behavior and Research*. 6(3), 145-159. https://doi.org/10.1108/13552550010346497.

Gerlind, W., Blandine, T., B., Ulrich B., Annemarie M., Gunda N., Guillermo J., S., Beatrice B. (2017). *Aftifical Intelligence and Robotics and their Impact on the workplace*. IBA Global Employment Institute.

Hair, J., F., Black, W., C., Babin, B., J., Anderson, & Rolph, E. (2014). *Multiple Data Analysis*, Pearson Education Limited.

Hill, R., & Stewart, J. (1999). Human resource development in small organizations, *Human Resource Development International*, 2(2), 103-124. http://doi.org/10.1080/13678869900000013.

IndustriALL Global Union, 2017. The challenge of Industry 4.0 and the Demand for New Answer.

International Labour Organization (2016). ASEAN in transformation, perspectives of enterprises and students on future work. Geneva: International Labour Office.

Jameson S. M. (2000). Recruitment and training in small firms, *Journal of European Industrial Training*, 24. 43-49.

Jamieson, S. (2004). Likert scales: How to (ab)use them. Medical Education. 38(12), 1217-1218. https://doi.org/10.1111/j.1365-2929.2004.02012.x.

Jan, S., Christopher, R., & Erik, S. (2017). *Industry 4.0 in Danish Industry*, Syddansk University, Denmark.

Janice J. (2004). Training and Development, and Business Growth: A study of Australian Manufacturing Small-Medium Sized Enterprises, *Asia Pacific Journal of Human Resources*, 42 (1), 96-122. https://doi.org/10.1177/1038411104041535.

KPMG (2016). The factory of the future, Industry 4.0 – The challenges of tomorrow.

Kruger, J. (2008). Productivity and Structural Change: A Review of the Literature, *Journal of Economic Surveys*, 22 (2), 330-363.

Li X. C. & Chris R. (2008). The development of Chinese small and medium enterprises and human resource management: A review. Asia Pacific Journal of Human Resources, 46(3): 353-379.

Hoang K. L , Nguyen T. K (2020). Fuzzy-AHP Application in Analyzing the Factors Affecting Quality of Rural Labor, Journal of Asian Finance, Economics and Business, 7 (8): 715–721. http://doi:10.13106/jafeb.2020.vol7.no8.715

Nguyen, P. T. H (2017). *Developing high-quality human resources at Vietnam Oil and Gas Group until 2025*, Doctoral thesis in Economics, University of Economics and Law - Vietnam National University, Ho Chi Minh City, Vietnam.

Nguyen, T. V. (2015). Research on factors affecting human resource development of garment enterprises in Tien Giang province. Doctoral thesis, National Economics University, Hanoi, Vietnam.

Nguyen, T. A. T (2014). Development of management staff in small and medium enterprises of Vietnam's animal feed industry. Doctoral Thesis in Human Resource Management, National Economics University, Hanoi, Vietnam.

Oscar, L. (2017). *Analysis of National Initiatives for Digitising Industry. Portugal Indústria 4.0*, European Commission.

Paul, J. D. (2016). Reskilling for the fourth Industrial revolution. Formulating a European strategy, *Policy paper*, 175, 1-16.

Silvio, A., Marco, P., Francesco, Q., Marco, Z., Silvia, F., Francesca, N., & Stefania, S. (2017). Unito and the challenges of Industry 4.0. University or Toronto, Canada.

Thai Nguyen Statistic office (2021). Thai Nguyen Statistical Yearbook. Thai Nguyen statistics publishing, Vietnam.

Received: Mar 03, 2023 Revised: Mar 07, 2023 Accepted: May 22, 2023