Information Technology Role in Education and Economic Growth

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Abstract

This study investigates the influence between information technology literacy, economic growth, education and unemployment in Indonesia.To investigate the causal link between variables, this research uses 21 years of data, from 2000 to 2020, by modeling "autoregressive vectors." This study is based on secondary data from the World Bank.We found that t he use of internet technology encourages economic growth, improves the quality of education and reduces unemployment. This reality is proof that technological developments are not always accompanied by an increase in unemployment. Internet technology provides profitable new job opportunities so as to reduce unemployment as a result of the creation of new jobs and economic growth from the creative and technology-based sector. Education provides an impetus for improving the quality of human resources so that people are more adaptable and more ready to participate in the economy which has an impact on reducing unemployment.

Keywords: Information Technology,Education,Economic Growth,Indonesia.

JEL Classification: C10, E04, E44

Received: Mei 12, 2021
Accepted: September 12, 2021

DOI : 10.54204/TMJI/Vol312021008

Introduction

Countries compete with each other to excel in the field of information and communication technology in their various sectors, and while information technology is a product and service itself is one of the biggest economic drivers of our time, and directly affects most sectors of the economy. Previous studies have examined the nature of the relationship between information technology and economic growth, so they studied the relationship between economic growth and any investment in communication infrastructure, Internet availability, digitization, and others (Sulisnaningrum, Widarni, & Bawono, 2022)..

Many of the previous studies show a strong positive relationship between information technology factors and economic growth. The positive impact of information technology on economic growth in a number of countries, among them is the reduction of poverty, the creation of new jobs, and an increase in per capita income (WIDARNI & BAWONO, 2021).

Information technology affects the economy in several ways, perhaps the most important of which is its positive impact on productivity. The adoption of information technology by companies increases their productivity in several ways, one of which is the use of technology to improve operating efficiency. Information technology also plays a key role in improving decision making and reducing errors and thus their costs. Technology also adds a lot to the ease and speed of communication with other companies, which contributes to increased work dynamism and reduces delay costs (Soniansih & Puspaningtyas, 2021).

The impact of information technology on society also cannot be ignored, because this technology has allowed knowledge to reach a large segment of society, thereby contributing to an increase in the level of education in the world. This knowledge has greatly increased the productivity of the company, for example, it is now easier for employees to search for information, and learn new skills when needed during working hours. This feature was not available two decades ago, and is still not available in some countries. When studying studies examining the relationship of information technology to economic growth, it becomes clear that higher-income countries benefit more from information technology in economic growth, while lower-income countries do not. Perhaps the biggest reason for this is the inability of individuals in low-income countries from information technology due to the low level of education in these countries, and thus the inability of the workforce to make optimal use of information technology (Bawono, 2021).

The economic role of information technology became clear during the Corona pandemic, so remote work is the main driver of enterprises worldwide, and the operations of many enterprises are not affected based on their rapid adaptation to remote work using information technology capabilities such as virtual meetings, cloud services and more. Paralysis would befall a number of sectors if it were not for the role of information technology, including the education, health and even logistics sectors (Sasongko, Bawono, & Prabowo, 2021).

Information technology today enables most sectors of the economy, and if its role today is important, its role in the future will only become more important. Investing in it today will pay off in the future, and countries which in the past neglected to invest in information technology infrastructure, and in qualifying their workforce to use it, lag far behind developed countries. Information technology is no less important and has an economic impact than the quality of laws and regulations and the skills of the workforce, and is one of the most important factors that foreign companies pay attention to when

investing in countries (Astuti & Prabowo, 2021). This study investigates the influence between information technology literacy, economic growth, education and unemployment in Indonesia.

Research Method

To investigate the causal link between variables, this research uses 21 years of data, from 2000 to 2020, by modeling "autoregressive vectors." This study is based on secondary data from the World Bank, and the following multivariate regression model was used to assess the causal association between internet users, economic development, education, and unemployment in Indonesia:

$IU_t = \beta_0 + \beta_1 EG_t + \beta_2 E_t + \beta_3 UE_t + e_t$ eql 1

$EG_t = \beta_0 + \beta_1 IU_t + \beta_2 E_t + \beta_3 UE_t + e_t$ eql 2

$E_t = \beta_0 + \beta_1 IU_t + \beta_2 EG_t + \beta_3 UE_t + e_t$ eql 3

$UE_t = \beta_0 + \beta_1 IU_t + \beta_2 EG_t + \beta_3 E_t + e_t$ eql 4

Description :

IU : Internet user

EG : Economic growth

E : Education

UE : Unemployment

E : error term

t : time series

β : the magnitude of the effect of causality

eql: equation

This study uses vector calculations where each regression relationship will be brought together so that each variable will alternately become the dependent variable and the independent variable. The zero theory of Dickey-Fuller, taken from the PP test, and p=1 is the formula in $\Delta yt = (\rho - 1)yt\text{-}1 + ut$, in which Δ – for the first time different operators. This research used the following equation for the "unit root test":

$\Delta Y_1 = \alpha_0 + \beta_0 T + \beta_1 Y_{t\text{-}1} + \sum_{i-1}^{q} \alpha_1 \Delta Y_{t\text{-}1} + e_t$

Description:

Y as the variable is being examined for unit root

T as the variable which indicates the “linear trend,” the “lag difference” means is $\Delta Yt-1$,

$\alpha 0$ are shown as “constant term,” with the

"t" as a "time trend" indicator.

The null and alternative hypotheses for the "unit root test" are as follows:

$H_{0:}\ \alpha=0$

$H_1: \alpha\neq 0$

Result and Discussion

The ADF Test takes into consideration the likelihood of autocorrelation in the error term if the series being evaluated is non-stationary. The following are the results of the unit root test:

Table 1: ADF's Unit Root Test on IU, EG, E, and UE data in Indonesia

Variable	Unit Root	Include in the examination Equation	Statistics for the ADF Test	5% Critical Value	Description
Internet User (IU)	Level	Intercept	6.626153	1.0000	
	First Diff	Intercept	-0.254496	0.9143	
	Second Diff	Intercept	-7.999192	0.0000	Stationer
Education (E)	Level	Intercept	0.330179	0.9721	
	First Diff	Intercept	-5.019844	0.0012	Stationer
Economy growth (EG)	Level	Intercept	-0.527808	0.8660	
	First Diff	Intercept	-1.929268	0.3129	
	Second Diff	Intercept	-3.319458	0.0293	Stationer
Unemployment (UE)	Level	Intercept	-0.606491	0.8482	
	First Diff	Intercept	-3.886074	0.0089	Stationer

IU and EG data are stationary at the second difference, and E and UE data at the first difference level are stationary. The ADF test is worth -7.999192 with a critical value of 0.0000. Smaller than the p-value, in this case, the IU data shows stationary in the second difference compared to the original data. From here we can take the next step in determining vector analysis.

Optimum Lag Test

VAR test and causality test both require the right sensitivity of lag length. It is very important to select an acceptable optimal lag period before undertaking a VAR or causality test study. The following are the results of the lag test:

Table 2 : Optimum lag test at Lag 0 to 2 IL, JP, E, and UE data in Indonesia

Lag	LogL	LR	FPE	AIC	SC	HQ

0	-130.3714	NA	86.26566	15.80840	16.00445	15.82788
1	-67.70433	88.47111*	0.382224*	10.31816*	11.29841*	10.41560*
2	-54.18661	12.72256	0.769516	10.61019	12.37464	10.78558

Table 2 shows the findings of the Optimum Lag test. At Lag 0 to 2, the results show that the variable lengths of Lag IU, EG, E, and UE are at LR, FPE, AIC, SC, and HQ at Lag 1. Since the findings of the five components are identical, lag 1 will be chosen.

Var Model Analysis

Table 4 : VAR Model Analysis

	IU	EG	E	UE
IU	0.853234	0.104759	0.553216	-0.088205
	(0.37498)	(0.18052)	(0.42741)	(0.17148)
	[2.27540]	[0.58032]	[1.29434]	[-0.51437]
EG	-0.919739	-0.226326	-0.646815	-0.066646
	(0.75151)	(0.36178)	(0.85658)	(0.34367)
	[-1.22386]	[-0.62559]	[-0.75511]	[-0.19393]
E	0.046087	0.097049	-0.671844	0.009555
	(0.24914)	(0.11994)	(0.28397)	(0.11393)
	[0.18498]	[0.80916]	[-2.36586]	[0.08386]
UE	0.806528	0.605567	-1.092679	-0.039750
	(0.98342)	(0.47343)	(1.12091)	(0.44972)
	[0.82013]	[1.27912]	[-0.97481]	[-0.08839]
C	-7.000555	-4.576837	89.06683	-0.324512
	(17.4338)	(8.39277)	(19.8713)	(7.97255)
	[-0.40155]	[-0.54533]	[4.48218]	[-0.04070]
R-squared	0.993181	0.454047	0.872025	0.921582
Adj. R-squared	0.986363	-0.091907	0.744050	0.843165
Sum sq. resids	13.44233	3.115318	17.46405	2.811166
S.E. equation	1.296261	0.624031	1.477500	0.592786
F-statistic	145.6573	0.831658	6.814030	11.75222
Log likelihood	-22.12612	-9.698457	-24.35087	-8.825235
Akaike AIC	3.661896	2.199818	3.923632	2.097087
Schwarz SC	4.103009	2.640931	4.364745	2.538199
Mean dependent	13.27427	5.390172	44.16298	5.766471
S.D. dependent	11.10016	0.597191	2.920452	1.496842

The relationship between IU and IU itself is significantly positive, with a coefficient of 0.853234 and a t-statistic of 2.27540. The relationship between IU and EG is significantly positive, with a coefficient of 0.104759 and a t-statistic of 0.58032, which means the higher the IU, the higher the EG. Likewise, the

relationship between IU and E is significantly positive, with a coefficient of 0.553216 and a t-statistic of 1.29434, meaning that the higher the IU, the higher the E. The relationship between IU and UE is significantly negative, as evidenced by the coefficient -0.088205 and the t-statistic -0.51437. This shows that the increase in internet users will encourage economic growth and education, but the decrease in internet users also causes unemployment to increase. This is in line with the significant negative relationship between EG and EU with a coefficient of -0.066646 and a t-statistic of -0.19393, meaning that a decrease in EG will cause a higher UE.

Granger Causality Analysis

Table 5 : Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
EG does not Granger Cause IU	19	0.58759	0.5688
IU does not Granger Cause EG		4.99919	0.0230
E does not Granger Cause IU	17	0.06363	0.9387
IU does not Granger Cause E		8.56634	0.0049
UE does not Granger Cause IU	19	0.39359	0.6819
IU does not Granger Cause UE		0.20651	0.8158
E does not Granger Cause EG	17	0.27521	0.7641
EG does not Granger Cause E		0.02294	0.9774
UE does not Granger Cause EG	19	1.66383	0.2248
EG does not Granger Cause UE		3.81897	0.0475
UE does not Granger Cause E	17	4.79928	0.0294
E does not Granger Cause UE		0.34028	0.7182

The results of the Granger causality test analysis can be seen in Table 4. The results show that the causal relationship only occurs in the variables IU to EG, IU to E, EG to UE, and UE to E with a probability value of less than five percent each. While the causality relationship between other variables is not significant.

Conclusion

The use of internet technology encourages economic growth, improves the quality of education and reduces unemployment. This reality is proof that technological developments are not always accompanied by an increase in unemployment. Internet technology provides profitable new job opportunities so as to reduce unemployment as a result of the creation of new jobs and economic growth from the creative and technology-based sector. Education provides an impetus for improving the quality of human resources so that people are more adaptable and more ready to participate in the economy which has an impact on reducing unemployment.

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