Human capital and internet literacy impact on economic growth in Indonesia

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Abstract

This study investigates the development of human capital in Indonesia through investment in education and health by the Indonesian government on job participation and economic growth. Modeling "autoregressive vectors" used to understand the causal link between variables required 21 years, from 2000 to 2020. The World Bank and the Indonesian Central Statistics Agency provided secondary data for this study. We use the variables of education, health, internet literacy, work participation, and economic growth in Indonesia. We found that internet literacy has a significant effect on economic growth and also provides a significant boost to education and health. Where education and health are the main factors forming human capital that have an impact on the quality of human resources. Improving the quality of education from the education and health development process has an impact on job participation. Employment participation itself encourages increased investment in education and health. This can illustrate the role of internet literacy and human capital on economic growth in Indonesia where economic growth can be boosted by increasing internet literacy and human capital.

***Keywords*:** Human capital, Internet literacy, Economic growth, Indonesia.
***JEL Classification Codes*:** C10, E24, O15.

1. Introduction

Today's nations are competing to develop their human resources, discover the talents of their members, and employ them to face the challenges and complexities of the times. One of the main assets of every country is its human resources. If we are to increase our chances of success in the face of global challenges, it is important to develop, to the maximum extent possible, human talent capable of finding solutions. This means making efforts to ensure that individuals find meaningful and adequate work so that they can become productive members of society. The bottom line is that there is a wide gap between our human potential and the reality in many workplaces around the world. To understand future trends and get an idea of which countries are doing best (Rusmingsih, Widarni, Bawono, 2021 ; Jahanger, Usman, Murshed, Mahmood, Balsalobre-Lorente, 2022).

Advances in mobile and cognitive computing, the Internet of things, cloud computing, and cognitive computing mean that the boundaries between home and office, public and private, and within and outside organizations are shifting, overlapping, and even blurring in some cases impacting human performance where the digitization of work has an impact on improving human performance. The increasing importance of workplace culture and employee involvement in improving human performance has become a concern in human resource development (Sulisnaningrum, Widarni, Bawono, 2022).

Human capital plays an important role in economic development; through the minds and trained personnel that have accumulated over time, and the human element was and is still one of the most important gears in the wheel of progress of any country. Because the human mind is the one that creates, innovates, and produces, any country's reliance on imported machines and trained manpower is insufficient for progress; instead, it must have a stock of conscious human capabilities capable of making the best use of these resources and encouraging developed countries. As a result, examining the link between human resource development and economic growth is critical. One of the most significant variables impacting economic development in a national economy or society is human capital investment. Human capital is formed not just through education and training, but also through the number of health and social services that help to create and preserve it (Aras & Ozturk, 2017; Wanger & Aras, 2022; Mora & Afriani, 2021).

There is a global debate about the fair distribution of human capital. This is seen in educated people migrating from the poorest places to the richest places in search of

opportunities. The rich get richer, and the poor get poorer. When workers migrate, the return of their education and education spending by their country usually returns to the country from which they migrated. It is undeniable that brain drain or migration of human capital is one of the negative outcomes of the migration of trained and talented people (human capital) to other countries. Brain drain occurs in two forms namely those who study abroad and then do not return to their home country after completing their studies, when those who have been educated in their country migrate to countries that offer better opportunities and higher salaries, It is the most dangerous among them as it drains more resources from the parent country (Sulisnaningrum, 2021).

There is another type, namely "brain gain", which is a position against the brain drain. The talented and trained migrated to other countries that attracted them. Here it becomes clear the process of exploitation of human capital which the country of the owner has not managed to invest in. The process is twofold, namely the investment of human capital by the country that draws it, and the waste from the country that drains it. Despite this impact, there are those who see unemployment as having benefits. Overemphasis on work culture in modern society; that is, tends to reduce employment rates, reduce jobs, create jobs that are fun and enjoyable rather than real jobs, and create cultural norms that view work as unhealthy. These people defend the "against work" movement in life, and the increase in unemployment helps reduce the inflation rate which has a negative impact on society as a whole, and it provides more opportunities for employers to choose among workers, while the reality confirms that there are workers who can occupy several jobs, the worker's lack of fear of losing his job (Marxist theory) also leads to abandoning his job or demanding higher wages.It is noted that everyone experiences an unemployment crisis, and when a crisis occurs, people come in with unfamiliar behavior (Steinberg, 2017).

Work is no longer just a means to achieve individual ambitions but has become an unattainable goal (Mora, 2021). This study investigates the development of human capital in Indonesia through investment in education and health by the Indonesian government on job participation and economic growth.

2. Literature Review

Economic theory's role in the issue of human capital is as ancient as economics. The human factor has been the focus of development since Adam Smith's early essays on the relevance of specialization and division of labor in the causes of national prosperity and growth.

Human capital is a critical component in the development process, according to the new economic growth model, and it is credited with the majority of global success. In several kinds of literature, human capital is described as a collection of talents, abilities, and experiences that a person accumulates that allow him to participate in the economy of life. Thus, achieving the economic benefits it derives, and then reflected on the whole society. There is a relationship between what is known as human development and economic growth, as each reflects positively and negatively on the other. Economic growth is achieved through increasing human capabilities, and achieving the desired growth is reflected in human development by expanding the choice of human resources in particular, and the population in general (Wolloch, 2020).

One of the most significant productive aspects is the human element that play a role in achieving development, without education it will not be able to carry out its role. The latter contributes to the accumulation of human capital. Economic growth theory suggests that technological progress increases the rate of economic growth in the long run and accelerates when the workforce is better educated; Therefore, human capital helps in technological progress and is one of the sources of sustainable growth. Increasing the rate of sustainable growth is achieved by increasing production capacity and investing in tangible and intangible assets, such as innovation, education, and training (Shahbaz, Song, Ahmad, Vo, 2022).

Human capital development can be through cognitive training, which involves organizations deploying social networks, logical analytics, and cognitive tools to find, attract, train, recruit and retain top talent. Human capital is a multidimensional and dynamic concept, which is characterized by strong interrelationships with other concepts, such as knowledge capital, social capital, and human development, but differs from those that focus on the human element only as one of the main determinants of economic growth, especially given the rampant manifestations of globalization and openness, and resulting in increased intensity of competition and the growing role of science, knowledge, and technology. human creativity in determining the competitiveness of different economies (Rahim, Murshed, Umarbeyli, Kirikkaleli, Ahmad, Tufail, Wahab, 2021).

Human capital is measured through four fundamental dimensions including capacity, which measures educational attainment across age groups, dissemination, which includes the use and assembly of skills through work, development, which reflects education level, quality of the education system, and on-the-job training, skills diversity, and knowledge, which

involves the breadth and depth of the specific skills used in the job. This includes an assessment of a country's economic complexity, opportunities for mid to high-skill positions, and the availability of people to fill these roles (Zhang & Wang, 2021).

Investment in the formation of human capital in its results exceeds the investment in material resources, so the development of human resources has become one of the most important issues that economists call to regard as the first productive element in the process of economic and social development, and in the effectiveness of material production elements that lack this effectiveness without humans (Widarni & Bawono, 2021).

3. Research Method

Modeling "autoregressive vectors" used to understand the causal link between variables required 21 years, from 2000 to 2020. The World Bank and the Indonesian Central Statistics Agency provided secondary data for this study. We use the variables of education, health, internet literacy, work participation, and economic growth in Indonesia.

To evaluate the causal relationship between education, health, internet literacy, work participation, and economic growth in Indonesia, the following multivariate regression model was used:

$$EG_t = \beta_0 + \beta_1 E_t + \beta_2 H_t + \beta_3 IL_t + \beta_4 WP_t + e_t \quad \text{eql 1}$$

$$E_t = \beta_0 + \beta_1 EG_t + \beta_2 H_t + \beta_3 IL_t + \beta_4 WP_t + e_t \quad \text{eql 2}$$

$$H_t = \beta_0 + \beta_1 EG_t + \beta_2 E_t + \beta_3 IL_t + \beta_4 WP_t + e_t \quad \text{eql 3}$$

$$IL_t = \beta_0 + \beta_1 EG_t + \beta_2 E_t + \beta_3 H_t + \beta_4 WP_t + e_t \quad \text{eql 4}$$

$$WP_t = \beta_0 + \beta_1 EG_t + \beta_2 E_t + \beta_3 H_t + \beta_4 IL_t + e_t \quad \text{eql 5}$$

Description :

EG : Economic growth

E : Education

H : Health

IL : Internet literacy

WP : Work participation

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

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: $\alpha\neq0$

4. Result and Discussion

4.1. Stationery Test

Data stationarity or unit root test is the first test that may be performed in VAR. Data stationarity is critical when doing data analysis in the form of time series. The ADF test may be used to determine whether or not a series is non-stationary. The error term is examined to see whether the series is stationary, which includes the possibility of autocorrelation if the series is not. After performing the unit root test, the following conclusions were reached:

Table 1: ADF's Unit Root Test on EG, E, H, IL, and WP in Indonesia

Variable	Unit Root	Include in the examination Equation	Statistics for the ADF Test	5% Critical Value	Description
Economic Growth (EG)	Level	Intercept	-0.527808	0.8660	
	First Diff	Intercept	-1.929268	0.3129	
	Second Diff	Intercept	-3.319458	0.0293	Stationer
Education (E)	Level	Intercept	0.011282	0.9491	
	First Diff	Intercept	-4.861012	0.0012	Stationer
Health (H)	Level	Intercept	-0.598411	0.8501	
	First Diff	Intercept	-3.732511	0.0123	Stationer
Internet literacy (IL)	Level	Intercept	6.626153	1.0000	
	First Diff	Intercept	-0.254496	0.9143	
	Second Diff	Intercept	-7.999192	0.0000	Stationer
Work participation (WP)	Level	Intercept	-2.412304	0.1510	
	First Diff	Intercept	-4.563916	0.0024	Stationer

The EG, E, H, and WP data are stationary at the first difference, while the IL data are stationary at the second difference. The statistical value in the Augmented Dickey-Fuller test is -7.999192, with a critical value of 0.0000. Smaller than the p-value, in this case, the IL data shows stationary in the second difference compared to the original data. From here, we can take the next step in defining vector analysis.

4.2. Optimum Lag Test

Appropriate lag length sensitivity is required for causality and VAR testing. Before doing a VAR analysis or a causality test, it's critical to determine the correct lag period. The shortest or lowest Akaike Information Criteria (AIC) was used to determine the optimal time lag in this experiment. Because the data used in this test include annual data with a 21-year data range, the gap length ranges from 0 to 2. This interval is thought to be long enough to depict EG, E, H, IL, and WP throughout the course of a whole year.

Table 2: AIC value at Lag 0 to 2 EG, E, H, IL, and WP data in Indonesia

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-172.0333	NA	85.30112	18.63509	18.88362	18.67715
1	-99.26557	99.57692*	0.624536*	13.60690	15.09812*	13.85928
2	-70.71552	24.04215	0.872086	13.23321*	15.96712	13.69590*

Table 2 shows the findings of the Optimum Lag test. The AIC value at Lag 0 to 2 indicates that the lengths of the Lag variables EG, E, H, IL, and WP are in LR, FPE, and SC at Lag 1. Because the results of the four criteria are both in lag 1, then lag 1 will be chosen. . The interactions between EG, E, H, IL, and WP are shown in the table during this period. Based on these data, there is no preliminary effect for the four variables, so according to FPE requirements, the best lag is at lag 1.

4.3. Var Model Analysis

VAR (Vector Autoregressive) is a multivariate forecasting model that may be used to build a forecasting system out of correlated time series data and assess the dynamic impacts of random events interfering with the system.

Table 3: Vector Model Analysis

	EG	E	H	IL	WP
EG	-0.347389	-1.042808	0.117174	-1.218051	0.364689
	(0.69304)	(1.20171)	(0.18967)	(0.88994)	(0.76511)
	[-0.50125]	[-0.86777]	[0.61778]	[-1.36870]	[0.47665]
E	-0.571112	-0.453282	0.074174	-0.545821	-0.253661
	(0.22993)	(0.39869)	(0.06293)	(0.29526)	(0.25384)
	[-2.48384]	[-1.13692]	[1.17872]	[-1.84863]	[-0.99929]
H	-0.969958	0.660598	0.147499	-2.680938	-4.639866
	(1.93974)	(3.36344)	(0.53087)	(2.49083)	(2.14145)
	[-0.50005]	[0.19641]	[0.27784]	[-1.07632]	[-2.16669]
IL	0.011866	0.722052	0.028649	0.607076	-0.165203
	(0.27908)	(0.48391)	(0.07638)	(0.35837)	(0.30810)
	[0.04252]	[1.49212]	[0.37510]	[1.69402]	[-0.53620]
WP	-1.178744	0.302179	0.069644	-0.758672	-0.603098
	(0.37579)	(0.65160)	(0.10285)	(0.48255)	(0.41486)
	[-3.13675]	[0.46375]	[0.67718]	[-1.57222]	[-1.45373]
C	100.7784	61.98214	-3.578776	74.74864	55.02759
	(32.9950)	(57.2123)	(9.03009)	(42.3691)	(36.4262)
	[3.05435]	[1.08337]	[-0.39632]	[1.76422]	[1.51066]
R-squared	0.867214	0.922363	0.814270	0.997163	0.749024
Adj. R-squared	0.701232	0.825318	0.582107	0.993618	0.435304
Sum sq. resids	7.736595	23.26123	0.579479	12.75713	9.429332
S.E. equation	0.983399	1.705184	0.269137	1.262791	1.085664
F-statistic	5.224743	9.504417	3.507327	281.2238	2.387555
Log likelihood	-18.42430	-28.88215	6.195784	-23.17552	-20.30400
Akaike AIC	3.097294	4.198121	0.505707	3.597423	3.295158
Schwarz SC	3.644075	4.744901	1.052487	4.144204	3.841939
Mean dependent	4.977976	45.16289	2.768404	17.21472	47.92842
S.D. dependent	1.799132	4.079874	0.416334	15.80659	1.444735

The relationship between EG and EG itself is significantly negative, with a coefficient of -0.347389 and a t-statistic of -0.50125, the relationship between EG and E is not significantly negative, with a coefficient of -1.042808 and a t-statistic of -0.86777. Likewise, the relationship between EG and H is significantly positive with a coefficient of 0.117174 and a t-statistic of 0.61778, meaning that the lower the EG, the higher the H. The relationship between EG and IL is significantly negative, as evidenced by the coefficient -1.218051 and the t-statistic -1.36870, meaning the lower the EG the higher the IL. The relationship between EG and WP is significantly positive, as evidenced by the coefficient of 0.364689 and the t-statistic of 0.47665, meaning that the higher the EG, the higher the WP. This shows that a high level of economic growth will encourage an increase in the work participation rate, conditions of increased economic growth will also cause health investment per percentage of GDP to also increase, but if conditions of economic growth are low, it will lead to high internet literacy.

4.4. Granger Causality Analysis

Granger causality is a test that assesses if two research variables have a causal or reciprocal connection by assessing whether they statistically affect each other (two-way or reciprocal relationship), have a one-way relationship, or have no relationship at all (do not influence each other).

Table 5 : Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
E does not Granger Cause EG	20	7.35363	0.0148
EG does not Granger Cause E		0.01829	0.8940
H does not Granger Cause EG	20	0.37299	0.5495
EG does not Granger Cause H		0.11538	0.7383
IL does not Granger Cause EG	20	8.66977	0.0091
EG does not Granger Cause IL		1.24169	0.2807
H does not Granger Cause E	20	0.34627	0.5640
E does not Granger Cause H		8.48254	0.0097
IL does not Granger Cause E	20	18.0644	0.0005
E does not Granger Cause IL		0.25726	0.6185
IL does not Granger Cause H	20	8.83818	0.0085
H does not Granger Cause IL		0.20202	0.6588
WP does not Granger Cause H	20	0.00647	0.9368
H does not Granger Cause WP		0.64019	0.4347

The results of Granger causality analysis with variables EG, E, H, IL, and WP indicate that there is a one-way relationship between variables E to EG, IL to EG, E to H, IL to E, and IL to H. significance (p-value) is less than or equal to 0.05.

5. Conclusion and Suggestions

Internet literacy has a significant effect on economic growth and also provides a significant boost to education and health. Where education and health are the main factors forming human capital that have an impact on the quality of human resources. Improving the quality of education from the education and health development process has an impact on job participation. Employment participation itself encourages increased investment in education and health. This can illustrate the role of internet literacy and human capital on economic growth in Indonesia where economic growth can be boosted by increasing internet literacy and human capital.

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