The Impact of Digital Technology Inclusion on Health, Education, and Agriculture Performance in Indonesia

Seni Soniansih
UIN Syarih Hidayatullah Jakarta, Indonesia

Abstract : This study examines the impact of digital technology inclusion on health,education, and agriculture performance in Indonesia. This study uses vector analysis to see the direction of the relationship between education investment, health investment, technology inclusion, and agriculture performance. The data used is secondary data with an annual period from 2000 to 2019. We found that Indonesia has successfully invested in education and health to improve agricultural performance supported by digital technology inclusion. This indicates that digital technology has an important role in having a positive impact on education and health investments to boost agricultural sector performance.

Keywords: Human Capital, Agriculture, Digital Technology Inclusion, Vector Analysis

JEL Classification : C01,E24,J24, O14

1 INTRODUCTION

Java is the most economically important island in Indonesia out of a total of more than 17,000 islands that make up Indonesia. Indonesia is very rich in land resources and exports coal, tin, copper, bauxite, and gold (Breuer et al,2021 ; Sulistiyono & Rochwulaningsih,2013). The largest gold mine in the world is in Indonesia. During ore extraction, waste is often discharged into rivers, which in turn causes environmental damage. When heavy metals get into the water, it has consequences for drinking water. People can no longer drink poisoned water, but fish also die and the water poisons the soil for agriculture. Petroleum, however, should be introduced in the meantime, as petroleum is not so much promoted anymore and energy demand is increasing as the industry grows. Most exports go to Japan, China, and Singapore, but also to the United States. Indonesia is rich in natural resources and also has fertile soil suitable for agriculture. Indonesia exports agricultural products such as palm oil, spices, soybeans, gum, cocoa, tea, coffee and tobacco. The problem is the growing cultivation of oil palm, from the fruit extracted from oil palm. To create space for plantations, a lot of forest has to be cleared and cleared. Palm oil is the most widely used vegetable fat in the world, and almost every second the product you buy in the supermarket contains palm oil. You can find it not only in cleansers or cosmetics, but also in many chocolate cones, in ice cream or even in pizza. Indonesia is the largest palm oil producing country in the world (Pye & Bhattacharya,2013 ; Cisneros et al., 2021).

Indonesia is committed to a digital future. Almost all young cities use smartphones. Paying for purchases and orders digitally is commonplace. And the digital industry has produced four unicorns with an estimated business value of at least US$1 billion (US$). Based on this, the Indonesian government in the spring of 2018 presented the “Making Indonesia 4.0” strategy, which aims to pave the way for the domestic economy towards a digital future. But no one still knows where the necessary knowledge should come from. Foreign companies report that it is increasingly difficult to find professionals in the information technology (IT) field - especially programmers and software engineers. And whoever can manage, has to dig deeper and deeper into their pockets. Thus, in the IT sector, in all other fields, often the large salary gaps between the country of origin of the company and Indonesia are increasingly converging (Jurriens & Tapsell,2017 ; Afrianty et al,2017).

Indonesia's biggest challenge in the field of education is no longer increasing access but improving quality. However, many assessments of the country's educational performance indicate that there is still a long way to go before achieving that goal. Many Indonesian teachers and lecturers lack the subject knowledge and pedagogical skills needed to be effective educators; student learning outcomes are poor, and there is a gap between the skills of graduates and the needs of employers. Education continues to be developed so that education in Indonesia is in accordance with the needs of the world of work (Priyono & Ahmad, 2018 ; Suryadarma, 2013). Indonesia, the fourth largest country in the world, measured by population, is struggling with the most virulent wave of infections to date in 2021. Hospitals are working at capacity limits and cemeteries are filling up fast. The health condition in Indonesia is currently in formidable challenges. Health is an important factor in the economy. Because health is something that is needed for humans to

work optimally..

2 LITERATURE REVIEW

In agriculture, crops are grown and animals are raised. You eat it or sell it. Many things can also be made from it. Therefore, agriculture is an important part of the economy. Without them, we would not have enough to eat and many others (Widarni & Drean,2021 ;). Digital IT and IT have one thing in common, they are abbreviations, but they are also very important for all users of all organizations, authorities, and companies of all sizes and industries as well as our professional and social lives. Without IT there is nothing left today, without IT there are almost no jobs in the modern world. The scope of the field of information technology goes far beyond classical computer science or electrical engineering. "IT" stands for information technology or information technology and is also called an information technology system. IT is a general term for everything related to information processing and business communication. It is also responsible for internal communications and electronic data processing.

The concept of education refers to spiritual, design, and moral development that occurs outside of reason and freedom and without direct dependence on politics and economics. General is not only the process but also the ideal conditions. Educational ideals include comprehensive education in the sciences and arts and bind research and teaching units, including freedom of knowledge. Education refers to the confrontation of a person with his environment with the aim of competent and responsible action. Education as a review and expansion of the construction of reality is thus more than just the transmission and acquisition of knowledge and qualifications, but education in the broad sense of self-enlightenment and emancipation. The concept of education is closely related to societal values and individual beliefs, that is, it is political and therefore mostly used without explicit justification of different interests. In addition, education is a process and a product of a process. The concept of a comprehensive education today goes far beyond the transmission of knowledge and traditional school education because education means the development of the whole personality, preparation for the future stage of life through the use of knowledge, and the possibilities of society. Education must and should also contribute to correcting social inequalities and improving the future prospects of people whose initial conditions were not favorable (Afriani,2021 ; Mora & Afriani,2021).

Defining health in a simple and unambiguous way is a demanding task. So far, the dominant understanding of health has focused on its negative aspects, namely its disadvantages. Health is synonymous with absence from disease. The definition of health is increasingly turning into a positive and dynamic concept. It speaks of health resources, health promotion, and health maintenance and is no longer solely the treatment of disease. Health is created and lived by humans in their daily environment. Where they play, learn, work and love. Health is created by taking care of oneself and others, by being able to make decisions for oneself and to exercise control over one's own living conditions, and by the fact that the society in which one lives creates conditions, enabling the health of all its citizens (Green, 2021 ; McCartney et al.,2019).

Economic growth will occur because there are more resources (material and/or human) that allow us to produce larger quantities. Economic growth is caused by increased productivity. Not just a fact to increase the productivity of machines and personnel, but especially in quality. And this is achieved mainly through improving the technology used or through the training of workers, as well as their experience, through which they know how to do their jobs better. Increasing human performance at work cannot be separated from human capital (Widarni & Bawono,2020).

3 RESEARCH OBJECTIVE AND METHODOLOGY

This study uses vector analysis to see the direction of the relationship between education investment, health investment, employment in agriculture and agriculture performance. The data used is secondary data with an annual period from 2000 to 2019.

4 RESULTS AND DISCUSSION

The table below presents a summary of descriptive statistics of several variables used in this study during the period 2000 to 2019.

Table 1. Descriptive statistics of agricultural performance in USD value in January 2021, education (investment in education in USD value in January 2021), and employment in agriculture (total working population)

	AGRICULTURE_VALUE_ADDED	EDUCATION	HEALTH	TECHNOLOGY_INCLUSION
Mean	8.48E+10	2.14E+10	1.78E+10	3.54E+07
Median	9.38E+10	2.10E+10	1.84E+10	2.25E+07
Maximum	1.42E+11	4.43E+10	3.25E+10	1.29E+08
Minimum	2.57E+10	3.68E+09	3.15E+09	1.96E+06
Std. Dev.	4.31E+10	1.36E+10	1.07E+10	3.65E+07

Based on Table 1 above, it appears that from the period 2000 to 2019, the average agricultural performance in Indonesia is very high at around 84.8 billion USD which can be seen from the mean value in Table 1. with a high level of volatility at 43.1 billion USD. With an average number of Digital Technology Inclusion 35.4 million people with an average educational investment value of 21.4 billion USD, and Health investment 17.8 billion USD. To see a more detailed and careful relationship of influence, vector analysis is carried out, namely Vector Autoregressive. Before estimating using Vector Autoregressive, there are several conditions that must be met from several observed variables, namely Stationarity Test, and Optimum Lag Test.

Cointegration test to see if there is a long-term relationship between variables and a causality test to see a reciprocal relationship between variables. Estimation using the VAR model requires all variables to be stationary at the level, if the variable is not stationary at the level, the estimation is carried out using the VECM model on the condition that all variables formed are cointegrated with each other where the results are shown in Table 2 below:

Table 2. stationarity test

Method			Statistic	Prob.**
ADF - Fisher Chi-square			6.97E+01	0.00E+00
ADF - Choi Z-stat			-7.03E+00	0.00E+00
Series	Prob.	Lag	Max Lag	Obs
D(AGRICULTURE_VALUE_ADDED,2)	3.80E-03	0.00E+00	3.00E+00	1.70E+01
D(EDUCATION,2)	0.00E+00	0.00E+00	3.00E+00	1.70E+01
D(HEALTH,2)	2.40E-03	1.00E+00	3.00E+00	1.60E+01
D(TECHNOLOGY_INCLUSION,2)	0.00E+00	0.00E+00	3.00E+00	1.70E+01

From the results of stationarity testing with Augmented Dickey-Fuller, it can be seen that at the 2nd level the difference is stationary and vector estimation uses Vector Autoregressive. It can be seen that the probability is less than 0.05 in each tested variable. After doing the stationarity test, a cointegration test was conducted to see the long-term integration between variables. If there is cointegration between variables, the estimation is made using the Panel Vector Error Correction Model (VECM) method, but if there is no cointegration, the estimation is made using the Vector Autoregressive method. Cointegration test results are shown in Table 3.

Table 3. Cointegration test results

Hypothesized		Trace	5.00E-02	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	8.15E-01	6.56E+01	4.79E+01	5.00E-04
At most 1 *	7.46E-01	3.53E+01	2.98E+01	1.06E-02
At most 2	3.79E-01	1.06E+01	1.55E+01	2.36E-01
At most 3	1.07E-01	2.04E+00	3.84E+00	1.53E-01

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From the cointegration result, the critical value is less than the Trace Statistics value and the Max-Eigen Statistics value which shows that there is have cointegration relationship in the variable equation so that the next method that can be used to determine the long-term and short-term relationship is the Vector Error Correction Model method.

Optimum lag test is used to determine the time period of the influence of a variable on other variables which will give optimal results. This is because changes in the movement of a variable are not directly responded to by changes in other variables, but there is still a certain grace period. Therefore it is important to know the lag length. The optimum lag test can be seen in Table 4.

Table 4. Optimum lag test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1589.771	NA	9.5E+71	177.0857	177.2836	177.113
1	-1506.473	120.3201*	5.7E+68	169.6081	170.5974*	169.7445
2	-1485.686	20.78661	4.68e+68*	169.0762*	170.857	169.3218*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

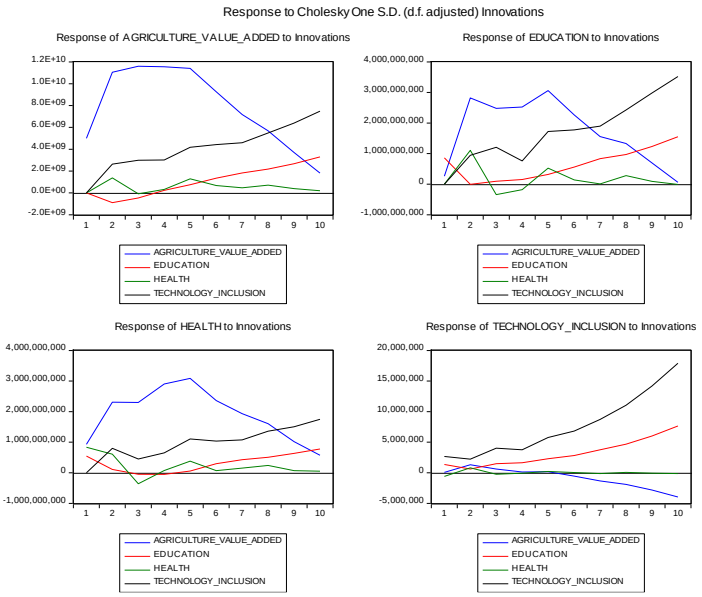
From the results of the Optimum lag test, it can be seen that the optimum lag is found in lag 2. The results of the Vector Autoregressive are shown in Table 5.

Table 5. The results of the Vector Error Correction Model estimation

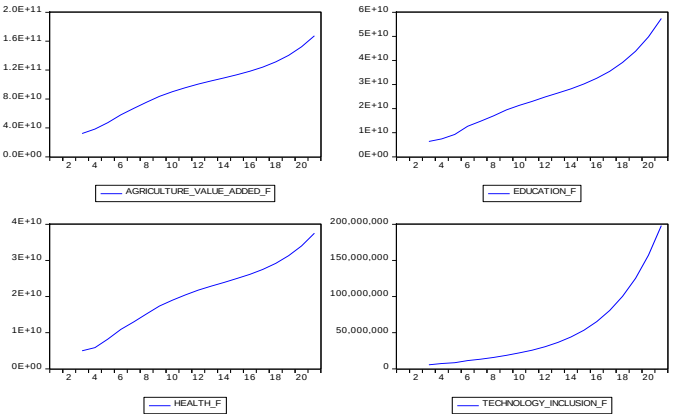
	AGRICULTURE_VALUE_ADDED	EDUCATION	HEALTH	TECHNOLOGY_INCLUSION
AGRICULTURE_VALUE_ADDED(-1)	1.970881*	0.346189*	0.330488*	4.13E-05*
	-0.35404	-0.06383	-0.09665	-0.00022
	[5.56686]	[5.42323]	[3.41938]	[0.19154]
AGRICULTURE_VALUE_ADDED(-2)	-9.78E-01*	-1.45E-01*	-1.28E-01*	-7.36E-05*
	-4.90E-01	-8.84E-02	-1.34E-01	-3.00E-04
	[-1.99346]	[-1.63940]	[-0.95804]	[-0.24652]
EDUCATION(-1)	-4.05E+00	-1.55E+00	-9.39E-01*	-1.56E-03*
	-1.65E+00	-2.98E-01	-4.52E-01	-1.01E-03
	[-2.45083]	[-5.20652]	[-2.07969]	[-1.54466]

EDUCATION(-2)	2.71E+00	4.95E-01*	1.11E+00*	-6.11E-04*
	-2.32E+00	-4.19E-01	-6.34E-01	-1.41E-03
	[1.16918]	[1.18237]	[1.75423]	[-0.43207]
HEALTH(-1)	2.34E+00	1.58E+00*	9.41E-01*	1.54E-03*
	-1.48E+00	-2.67E-01	-4.04E-01	-9.00E-04
	[1.57847]	[5.90310]	[2.32826]	[1.71186]
HEALTH(-2)	-1.25E+00	-4.88E-01*	-9.52E-01*	3.83E-04*
	-2.23E+00	-4.02E-01	-6.09E-01	-1.36E-03
	[-0.56193]	[-1.21299]	[-1.56414]	[0.28168]
TECHNOLOGY_INCLUSION(-1)	9.88E+02	3.54E+02	3.00E+02	8.33E-01*
	-4.98E+02	-8.97E+01	-1.36E+02	-3.03E-01
	[1.98520]	[3.94784]	[2.20956]	[2.74747]
TECHNOLOGY_INCLUSION(-2)	-9.13E+02	-1.09E+02	-3.57E+02	8.63E-01*
	-7.58E+02	-1.37E+02	-2.07E+02	-4.62E-01
	[-1.20393]	[-0.79497]	[-1.72432]	[1.86818]
C	6.29E+09	2.77E+08	-1.42E+09	2.90E+06
	-5.40E+09	-9.80E+08	-1.50E+09	-3.30E+06
	[1.16124]	[0.28335]	[-0.96098]	[0.87916]
R-squared	9.92E-01	9.97E-01	9.90E-01	9.96E-01
Adj. R-squared	9.85E-01	9.95E-01	9.81E-01	9.93E-01
Sum sq. resids	2.25E+20	7.32E+18	1.68E+19	8.36E+13
S.E. equation	5.00E+09	9.02E+08	1.37E+09	3.05E+06
F-statistic	1.36E+02	4.31E+02	1.14E+02	3.08E+02
Log likelihood	-4.21E+02	-3.90E+02	-3.98E+02	-2.88E+02
Akaike AIC	4.78E+01	4.44E+01	4.52E+01	3.30E+01
Schwarz SC	4.83E+01	4.48E+01	4.57E+01	3.34E+01
Mean dependent	9.14E+10	2.34E+10	1.94E+10	3.90E+07
S.D. dependent	4.02E+10	1.29E+10	1.00E+10	3.68E+07

Based on the results of the estimated output, it can be indicated the direction of the relationship, and the significance of each variable and each period. Negatively related variables are marked (-). Significant relationships are marked with a sign (*). The value of the coefficient of determination (Adj. R-Square) shows the degree of truth of the estimate of 0.988. This means 99% accuracy of the calculation rate of the vector error correction model. Impulse Response Function (IRF) describes the response of an endogenous variable to shock that occurs in other variables in a dynamic VAR system. IRF can be used to see the effect of fluctuations or shocks from one variable on the value of another variable either now or in the future. The results of the Impulse Response Function (IRF) of the Infrastructure variable against other variables are shown by the following Impulse Response graph:



Based on the response and impulse graphs, it can be seen that each variable responds to each other since the first time period with a lag of 2. This shows that in Indonesia the three variables influence each other. To see the direction of influence can be seen in the following forecasting chart:



Based on the forecast graph, it can be seen that the growth of agricultural performance is in line with investment in education and health, Technology Inclusion in Indonesia. This shows that Indonesia has successfully invested in education and health to improve agricultural performance supported by technology inclusion. This indicates that digital technology has an important role in having a positive impact on education and health investments to boost agricultural sector performance.

5 CONCLUSION

Indonesia has successfully invested in education and health to improve agricultural performance supported by digital technology inclusion. This indicates that digital technology has an important role in having a positive

impact on education and health investments to boost agricultural sector performance.

REFERENCES

Afriani,I.H. (2021). Educational Psychology: Understanding Child Development. Singapore : Triple Nine Communication Press

Afrianty,T.W., Artatanaya,I.G.L.S., Burgess,J. (2021). Working from home effectiveness during Covid-19: Evidence from university staff in Indonesia. Asia Pacific Management Review [Online], https://doi.org/10.1016/j.apmrv.2021.05.002

Breuer,L.E., Guajardo,J., Kinda,T. (2018). Realizing Indonesia's Economic Potential. Washington DC : International Monetary Fund.

Cisneros,E., Kis-Katos,K., Nuryartono,N. (2021). Palm oil and the politics of deforestation in Indonesia. Journal of Environmental Economics and Management,108(6). 42-53. doi : 10.1016/j.jeem.2021.102453

Green, C. (2021). Examining and Solving Health Disparities in the United States Emerging Research and Opportunities .Hershey : IGI Global.

Jurriens,E., Tapsell,R. (2017). Digital Indonesia: Connectivity and Divergence. Heng Mui Keng Terrace : ISEAS Publishing

McCartney,G., Popham,F, McMaster,R., Cumbers,A.(2019). Defining health and health inequalities.Public Health, 172 (7), 22-30. doi : 10.1016/j.puhe.2019.03.023

Mora,A.G.O., Afriani,I.H. (2021). Increasing the Resilience of Students in Educational and Economic Inequalities from a Psychological and Human Capital Point of View. Tamansiswa Management Journal International,1(1),41-44.

Priyono, D. , Ahmad, A. (2018). The Implementation of Higher Education Funding in Indonesia. Open Access Library Journal, 5, 1-11. doi: 10.4236/oalib.1104049.

Pye,O, Bhattacharya,J. (2013). The Palm Oil Controversy in Southeast Asia A Transnational Perspective. Pasir Panjang : ISEAS Publishing

Sulistiyono,S.T., Rochwulaningsih,Y. (2013). Contest for hegemony: The dynamics of inland and maritime cultures relations in the history of Java island, Indonesia.
Journal of Marine and Island Cultures,2(2).115-127. doi : 10.1016/j.imic.2013.10.002

Suryadarma, D. (2013) .Education in Indonesia .Pasir Panjang : ISEAS Publishing

Widarni,E.L, Bawono,S. (2020). Human Capital Investment For Better Business Performance. Singapore: Triple Nine Communication

Widarni,E.L., Drean,B.(2021). Vector Analysis Study in 22 Country in 5 Continent About Human Capital And Agriculture. Malang : Janega Press