Health and Education Investment in the Development of Food Security in Indonesia

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Abstract : This study aims to understand the direction of the relationship between human capital, employment in agriculture, and agriculture value-added (agriculture performance). In developing human capital there are two main indications, namely health and education. So that in looking at the direction of the relationship between human capital and employment in agriculture, and agriculture value-added, one can observe the direction of the relationship between education investment, health investment, employment in agriculture, and agriculture value-added. In this study, we use secondary data from the world bank that we process and use to understand the effectiveness of human capital investment in each country and the interest of educated citizens in the agricultural sector in relation to the performance of the agricultural industry. The research period that we took was adjusted to our research period, which is from 2000 to 2019. We focused on the analysis before the covid-19 pandemic occurred to avoid biasing the analysis results with Vector Error Correction Model. We found that Indonesia has succeeded in successfully investing in education and health to improve agricultural performance. Employment in agriculture in Indonesia has shown a decline in employment in agriculture every year until the end of our research period in 2019. This is a bad indication because the continued decline in employment threatens the sustainability of agriculture in Indonesia and threatens food security. in Indonesia. To overcome this, it is necessary to understand the importance of domestic agriculture and increase the interest of Indonesia's young generation to work in agriculture and improve agricultural technology to streamline human resources in agriculture.

Keywords: Human Capital, Agriculture, Employment in Agriculture, Vector Analysis

JEL Classification : C01,E24,J24, J43

1 INTRODUCTION

Indonesia, with its abundant natural wealth and fertile land, has the potential to develop agriculture and develop an agriculture-based economy. A large number of people can be utilized to develop Indonesian agriculture in maintaining food independence (Saputra et al,2017).

Food independence is very important. Where food independence can guarantee the entire population remains secure in obtaining healthy and nutritious food. This is related to the health of the population. Where health is an important factor in nation-building (Quinn et al,2014). Health and education are two vital factors in developing human capital (Van Fleet, 2018). Human capital can be used in productive activities including agricultural development activities. Agricultural development in order to increase food self-sufficiency is a vital thing that needs to be jointly developed by the entire population of various professions. Human capital plays a role as a driver of human productivity in developing Indonesian agriculture (Nasikh et al,2021).

This study aims to understand the direction of the relationship between human capital, employment in agriculture, and agriculture value-added (agriculture performance). In developing human capital there are two main indications, namely health and education. So that in looking at the direction of the relationship between human capital and employment in agriculture, and agriculture value-added, one can observe the direction of the relationship between education investment, health investment, employment in agriculture, and agriculture value-added

2 LITERATURE REVIEW

Agriculture is an activity related to the production of tillage, development, and collection of plants, as well as forest and forest exploitation (forestry), breeding, and development of livestock. It is one of the main sector activities of every country, being the most important resource and owned by humans for their livelihood because some of the agricultural products are consumed directly and some are provided for the industry to obtain food derivatives, textiles, chemicals, or manufacturing (Rana, 2018). Agriculture has always been an active representative of the development and evolution of human civilization around the world, it also represents the survival of humans who have managed to adapt for themselves since the dawn of mankind. Today agriculture is considered an important food practice for human subsistence. Today, fruits and vegetables are more accessible than ever, but there is a lot of work behind it that isn't always visible. It serves as a starting point for a short journey through the history of agriculture, which should begin with how the ancient practice that is ubiquitous today was discovered.

The transition from nomadic to sedentary life was the origin of agriculture, as nomads lived primarily by hunting and gathering. On the other hand, sedentarization allows people to stay in place for long periods of time. It was in this way that agriculture was invented. Thanks to it, perfect conditions were created for the formation of the first people and the creation of a food system based on rationalization. With the origin and improvement of agriculture, humans ceased to face constant food shortages (carnivorous diets). Thus, it becomes possible to rely on it for subsistence (omnivorous diet). This is also how humans started breeding cows. After that, they get rid of weeds, organize vegetable gardens and develop knowledge about crops, their cultivation and harvesting (Holmes et al,2021). Today, agriculture is one of the fundamental activities of the primary sector and a source of livelihood for a large part of the population of our planet. Modern agriculture relies on and is intrinsically linked to scientific, physical, and biological research. A large number of advances in this field of knowledge allow optimization of production and harvesting processes and transform agricultural activities into more sustainable practices. Thanks to people dedicated to agronomic techniques, processes such as irrigation, drainage, conservation, and sanitation are constantly evolving.

Agricultural chemistry, on the other hand, deals with the application of fertilizers, insecticides, and fungicides, soil improvement, analysis of agricultural products, etc. While it is true that in many cases these substances may be required, the need to develop sustainable agricultural activities demands the search for alternatives to these products. The goal is to find a substitute that offers the same benefits as the chemical but without the negative effects of using it (Shareef & Zhao, 2017). In the agricultural sector, there has also been a large increase in the processing, processing, packaging, and sales of agricultural products. Other processes, such as freezing and dehydration, have opened the door to the expansion of agricultural trade and the food possibilities available to us.

Human capital is a measure of the economic value of a person's professional skills. It also refers to the factor of production of labor, which is the hours people devote to the production of goods or services. A person's human capital is calculated as the present value of all the future benefits expected to be derived from their job until they stop working. This added to the financial capital represents a person's total wealth. Being a future sum, this is bigger the younger a person is because older people have already acquired these benefits and have consumed or saved them, now forming part of their financial capital. The amount of human capital is not the same throughout life and decreases over time, but it can be increased through investment. The education, experience, and skills of an employee have economic value (Gong, 2016).

In the world of investing, this is a very important concept, as it is considered a part of a person's total wealth. In turn, it is considered to establish an appropriate asset allocation strategy. In general, human capital is considered as if allocated to fixed income (bonds). This is because profits come in the form of periodic income and do not carry as much risk as equity (shares). Therefore, if a person wants to allocate half of their money to equity and the other half to fixed income, adding the human capital factor should increase their allocation of financial capital to equity and reduce fixed income. By investing in human capital, factor productivity is increased and technological progress is promoted. In addition, investing in them can get many benefits in other areas, such as social or scientific benefits, among others. To designate the human capital of an organization, the concept of human resources is used. Companies rely heavily on the skills and talents of their employees, which is the key to the company's success. It is often said that a company is only as good as its employees, and that is why the human resources department pays great attention to the selection, management, and optimization of personnel (Barbi & Mattioli,2019).

3 RESEARCH OBJECTIVE AND METHODOLOGY

In this study, we use secondary data from the world bank that we process and use to understand the effectiveness of human capital investment in each country and the interest of educated citizens in the agricultural sector in relation to the performance of the agricultural industry. The research period that we took was adjusted to our research period, which is from 2000 to 2019. We focused on the analysis before the covid-19 pandemic occurred to avoid biasing the analysis results. In accordance with the purpose of this study, namely to analyze the relationship model between the key variables, namely human capital represented by education investments made by the government, work participation in agriculture, and agricultural industry performance. We derive an econometric model with a Vector Autoregressive approach that focuses on phenomena with the assumption that the autoregressive vector model does not differentiate between exogenous and endogenous variables. Therefore, one variable can be an independent variable in an equation and can also be a dependent variable in another equation. The basis for taking the key

variables is the theory of human capital which becomes education as a mechanism in developing human capital (Widarni & Bawono, 2021). Where human capital has an impact on human work performance itself. This study using vectors which are generally used in atheory research so that human capital theory is used as a determinant of key factors, not as the basis for econometric equations. The results of the vectoring carried out in this study can be described through the estimation of the IRF (impulse response function) estimation. The next step is to forecast the influence of each variable in the form of a forecasting graph so that it can be seen clearly the combination of the direction of the relationship or the influence of each variable.

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	EMPLOYMENT_IN_AGRICULTURE	HEALTH
Mean	84800000000.0000	21400000000.00	43143235.00	17800000000.00
Median	93800000000.0000	21000000000.00	43672827.00	18400000000.00
Maximum	142000000000.0000	44300000000.00	46240097.00	32500000000.00
Minimum	25700000000.0000	3680000000.00	38703822.00	3150000000.00
Std. Dev.	43100000000.0000	13600000000.00	2267787.00	10700000000.00

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 workers 43.14 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			61.57	0.00
ADF - Choi Z-stat			(6.55)	0.00
Series	Prob.	Lag	Max Lag	Obs
D(AGRICULTURE_VALUE_ADDED,2)	0.0038	0.00	3.00	17.00
D(EDUCATION,2)	0.0000	0.00	3.00	17.00
D(EMPLOYMENT_IN_AGRICULTURE, 2)	0.0002	3.00	3.00	14.00

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	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.8231	60.22	47.86	0.00
At most 1	0.6183	29.04	29.80	0.06
At most 2	0.3920	11.70	15.49	0.17

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	(1550.1720)	NA	1.17E+70	172.69	172.8836	172.713
1	(1498.6900)	74.36	2.40E+68	168.74	169.7327	168.8798
2	(1471.5010)	27.18948*	9.68e+67*	167.5001*	169.2808*	167.7456*

* 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

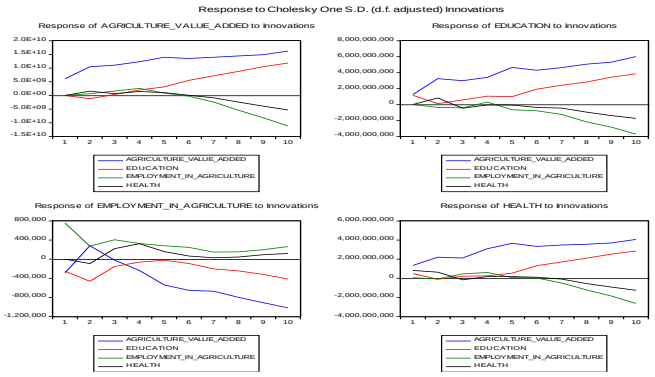
From the results of the Optimum lag test, it can be seen that the optimum lag is found in lag 2. The results of the Vector Error Correction Model are shown in Table 5.

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

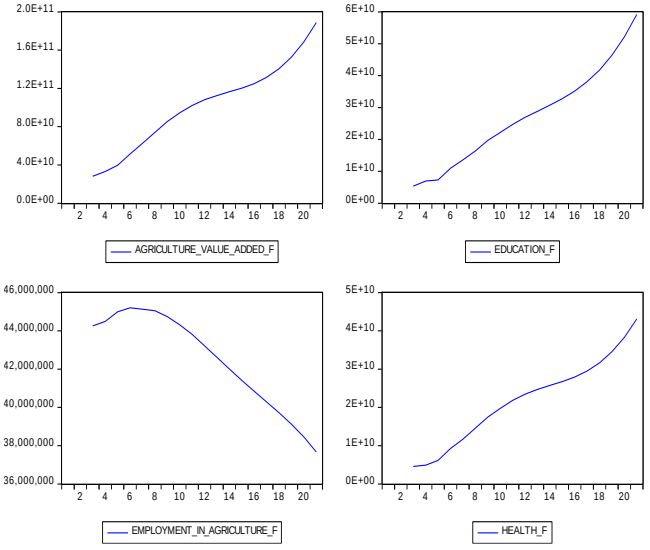
	AGRICULTURE_VALUE_ADDED	EDUCATION	EMPLOYMENT_IN_AGRICULTURE	HEALTH
AGRICULTURE_VALUE_ADDED(-1)	1.68E+00*	3.79E-01*	1.45E-04*	2.75E-01*
	-5.11E-01	-1.42E-01	-7.10E-05	-1.38E-01
	[3.29717]	[2.65873]	[2.04967]	[1.98551]
AGRICULTURE_VALUE_ADDED(-2)	-1.15E+00*	-1.98E-01	-1.73E-04*	-1.53E-01
	-5.80E-01	-1.62E-01	-8.00E-05	-1.57E-01
	[-1.98735]	[-1.22474]	[-2.15346]	[-0.97607]
EDUCATION(-1)	-1.70E+00	-4.47E-01*	-2.76E-04	-4.44E-01*
	-1.22E+00	-3.40E-01	-1.70E-04	-3.30E-01
	[-1.39804]	[-1.31588]	[-1.63433]	[-1.34379]
EDUCATION(-2)	3.57E+00	1.35E+00*	4.23E-05*	9.86E-01
	-1.51E+00	-4.20E-01	-2.10E-04	-4.08E-01
	[2.37324]	[3.21031]	[0.20301]	[2.41787]
EMPLOYMENT_IN_AGRICULTURE(-1)	6.71E+02*	-5.66E+02*	3.69E-01*	-1.41E+02*
	-1.79E+03	-4.98E+02	-2.47E-01	-4.84E+02
	[0.37551]	[-1.13655]	[1.49233]	[-0.29239]
EMPLOYMENT_IN_AGRICULTURE(-2)	-6.03E+01	-6.73E+02*	1.12E-01*	3.50E+02*
	-1.88E+03	-5.25E+02	-2.61E-01	-5.10E+02
	[-0.03204]	[-1.28098]	[0.42848]	[0.68533]
HEALTH(-1)	1.88E+00	9.92E-01*	-1.12E-04*	7.79E-01*
	-1.86E+00	-5.18E-01	-2.60E-04	-5.03E-01
	[1.01484]	[1.91648]	[-0.43556]	[1.54851]
HEALTH(-2)	-2.14E+00	-1.67E+00*	3.96E-04*	-8.90E-01*
	-1.74E+00	-4.84E-01	-2.40E-04	-4.70E-01
	[-1.23412]	[-3.43909]	[1.64538]	[-1.89274]
C	-1.78E+10	5.39E+10	2.41E+07	-9.77E+09
	-9.90E+10	-2.70E+10	-1.40E+07	-2.70E+10
	[-0.18082]	[1.96203]	[1.76639]	[-0.36602]
R-squared	9.88E-01	9.91E-01	9.32E-01	9.86E-01
Adj. R-squared	9.77E-01	9.82E-01	8.72E-01	9.73E-01
Sum sq. resids	3.36E+20	2.61E+19	6.44E+12	2.46E+19
S.E. equation	6.11E+09	1.70E+09	8.46E+05	1.65E+09
F-statistic	9.12E+01	1.20E+02	1.55E+01	7.71E+01
Log likelihood	-4.25E+02	-4.02E+02	-2.65E+02	-4.01E+02
Akaike AIC	4.82E+01	4.57E+01	3.04E+01	4.56E+01
Schwarz SC	4.87E+01	4.61E+01	3.09E+01	4.60E+01
Mean dependent	9.14E+10	2.34E+10	4.31E+07	1.94E+10
S.D. dependent	4.02E+10	1.29E+10	2.37E+06	1.00E+10

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 1. 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 forecasting graph, it can be seen that the growth of agriculture performance is in line with or in line with education and health investment in Indonesia. This indicates that Indonesia has succeeded in successfully investing in education an health to improve agricultural performance. Employment in agriculture in Indonesia has shown a decline in employment in agriculture every year until the end of our research period in 2019. This is a bad indication because the continued decline in employment threatens the sustainability of agriculture in Indonesia and threatens food security. in Indonesia. To overcome this, it is necessary to understand the importance of domestic agriculture and increase the interest of Indonesia's young generation to work in agriculture and improve agricultural technology to streamline human resources in agriculture.

5 CONCLUSION

Indonesia has succeeded in successfully investing in education and health to improve agricultural performance. Employment in agriculture in Indonesia has shown a decline in employment in agriculture every year until the end of our research period in 2019. This is a bad indication because the continued decline in employment threatens the sustainability of agriculture in Indonesia and threatens food security. in Indonesia. To overcome this, it is necessary to understand the importance of domestic agriculture and increase the interest of Indonesia's young generation to work in agriculture and improve agricultural technology to streamline human resources in agriculture.

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