

# Human Capital and Agriculture Performance Vector Analysis in Tanzania

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**Abstract :** This study examines the direction of the relationship between human capital and agriculture where education and health are indicators of human capital development in this study. For indicators of agricultural development, we focus on agriculture performance and employment in agriculture. 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. We found that agricultural performance growth is not only in line with investment in education and health. But also, on employment in agriculture in Tanzania. This shows that Tanzania has succeeded in investing in education and health to improve agricultural performance as well as indicating that by improving human capital in Tanzania it increases employment, especially in the agricultural sector.

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

**JEL Classification :** C01,E24,J24,J43

## 1 INTRODUCTION

Tanzania is in East Africa just below the equator, the largest country on the continent. At 365,756 square miles, it's twice the size of California. Tanzania has one of the most unique landscapes you will ever experience. Grasslands, forests, mountains, and rock formations make up its diverse ecosystem. Thirty percent of Tanzania is occupied by some of the largest and best national parks in the world. They are home to 340 species of mammals and over 1000 birds. No wonder Tanzania is a favorite for safari lovers (Foley et al,2014 ; Frumence et al,2021). Tanzania has the highest mountain in Africa. Mount Kilimanjaro rises to 19,341 feet above sea level. It is considered a "walkable" mountain. In other words, no technical climbing skills are required to reach Uhuru Point which is the peak. Even if you don't need ropes, ice

picks, or belt pieces to get to the top; it is still a challenging climb. Overcoming high disease is a test for citizens of all levels (Noe,2014).

The goal of many developing countries is to improve health in rural areas. Rural ambulances in countries like Tanzania can make a difference, especially for frequent deliveries. Most of the emergency transportation is done for pregnant women. In this situation, access to health care facilities with trained staff is a major need to improve the safety of mothers and children during work. Health is one of the important pillars in keeping the Tanzanian population productive to build their country (Verdeja et al.,2019 ; Cassidy et al., 2021) .

Many young people in Tanzania have few opportunities and work on small plots, their own or those of foreigners. To learn a profession, a high school diploma is required, but for this reason, many families have a lack of money or school is too far away. In addition, the vocational training offers that exist for many are unaffordable and not adapted to the local labor market. Agriculture is one of the most important sectors in Tanzania. Millions of Tanzanians are employed in the agricultural sector. Regarding salary, it is still far from enough to live on. Agriculture accounts for almost half of Tanzania's GDP. Therefore, this sector is very important. Due to poor soil quality and exports, there is not enough food to grow for their own needs, leading to more hunger in Tanzania (Delesalle,2021 ; Kerega,2019).

In Tanzania, there are public schools and courses to develop human capital in Tanzania. In addition to specialist skills, the young girls and boys in the course also strengthen their social and self-skills. Because after the school period where they had to learn mainly externally, they now had to study, develop ideas, communicate clearly and think together. Courses are also about reliability, self-initiative, and self-confidence. For those who are looking for work, must be convincing. Those who want to be independent must be able to market and sell their own products. Thus, young people also learn entrepreneurial skills such as business planning, marketing, or financial management. This is how shortsightedness evokes an entrepreneurial spirit and belief in a better future. Human capital development through education is very important (Mwakanyamale & Ndomondo, 2019 ; Zhou et al.,2020).

## 2 LITERATURE REVIEW

Agriculture is that which belongs to or is associated with Agriculture. This term relates to cultivating or cultivating

land, including all activities related to growing vegetables and tillage. Therefore, agribusiness consists of socio-economic activities that allow wealth to be obtained from the state. Products obtained from agricultural operations are known as agricultural products because they include agricultural and livestock production. Agricultural activities are part of the primary sector of the economy, which means the transformation of natural resources into unprocessed products. Agriculture, animal husbandry, beekeeping, hunting, fishing, and logging are included in the primary sector. Agricultural exploitation can be direct (if the owner is directly responsible for the operation) or indicated (if the land use is leased or transferred). Both farmings can be carried out by wage earners (paying per working day), employees (with a relationship of dependence on the owner and monthly salary), or through family work (the owner and his relatives devote themselves to working in the fields) (Drean & Bawono,2021 ; Widarni & Drean,2021).

The definition of education means not only the acquisition of knowledge but also the way we teach children to use reason. Looking at the previous ways of education, we get the picture that our children are not interested in the learning process, do not know how to relate content from various fields, and mostly learn "for assessment". Education is very important in developing attitudes, knowledge, and mastery of technology, and developing skills (Afriani,2021 ; Mora & Afriani,2021). The development of the health system is very important to maintain the productivity of the population. Home visits by doctors and nurses can provide a unique perspective on a patient's life that is not available during an office or hospital visit. This type of health care provision can promote a doctor-patient relationship and increase the physician's understanding of the patient's environment and level of social support. Health is not only physical health but mental and social health. This health must be maintained properly. It aims to create a comfortable and healthy life.

Capital refers to a company's wealth in the form of money or assets, which can be used to start a business or invest in a current business to make more money. There are two types of physical or human capital. Physical capital means tangible capital, such as money, plants, machinery, furniture and equipment, buildings, etc. On the other hand, human capital is a relatively new concept, which involves collecting skills, abilities, talents, knowledge, etc., which a company uses to fulfill its long-term goals. It is not owned by the employees, who rent it out to the company with adequate consideration. Human capital means the experience an employee needs for an

organization in knowledge, skills, abilities, talents, intelligence, values, etc., which he earns from time to time. As a result, employees are considered an asset whose value can be increased by investing in their training and development and any other means of the company. This concept clearly shows that not all employees work together and have different abilities. Simply put, it shows the total value of a company's intellectual capital, which is a source of continuous creativity and innovation. This is the standard used to determine the economic value of an employee's qualifications. Human capital is not owned by the company but is rented from employees, so the uncertainty of loss remains when employees leave the organization (Bawono & Wilantari,2021 ; 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 PERFORMANCE	EDUCATION	HEALTH	EMPLOYMENT IN AGRICULTURE
Mean	8.67E+09	1.27E+09	1.51E+09	1.50E+07
Median	7.88E+09	1.31E+09	1.61E+09	1.48E+07
Maximum	1.64E+10	2.46E+09	2.29E+09	1.77E+07
Minimum	3.50E+09	4.20E+08	4.57E+08	1.34E+07
Std. Dev.	4.60E+09	6.74E+08	5.61E+08	1.29E+06

Based on Table 1 above, it appears that from the period 2000 to 2019, the average agricultural performance in Tanzania is very high at around 8.67 billion USD which can be seen from the mean value in Table 1. with a high level of volatility at 4.6 billion USD. With an average number of workers 15 million people with an average educational investment value of 1.27 billion USD, and Health investment 1.51 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	6.16E+01	0.00E+00
ADF - Choi Z-stat	6.60E+00	0.00E+00

Series	Prob.	Lag	Max Lag	Obs
D(AGRICULTURE_PERFORMANCE,2)	6.00E-04	2.00E+00	3.00E+00	1.50E+01
D(EDUCATION,2)	4.00E-04	1.00E+00	3.00E+00	1.60E+01
D(HEALTH,2)	1.00E-04	0.00E+00	3.00E+00	1.70E+01
D(EMPLOYMENT_IN_AGRICULTURE,2)	2.70E-03	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	Eigenvalue	Trace Statistic	Critical Value	Prob.**
None *	7.15E-01	5.59E+01	4.79E+01	7.30E-03
At most 1 *	6.30E-01	3.33E+01	2.98E+01	1.91E-02
At most 2	4.73E-01	1.54E+01	1.55E+01	5.18E-02
At most 3 *	1.93E-01	3.87E+00	3.84E+00	4.92E-02

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	1.40E+03	NA	7.81E+62	1.56E+02	1.56E+02	1.56E+02
1	1.32E+03	120.2498*	4.72E+59*	1.49E+02	149.6844*	148.8315*
2	1.30E+03	1.62E+01	6.47E+59	148.6766*	1.50E+02	1.49E+02

\* 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

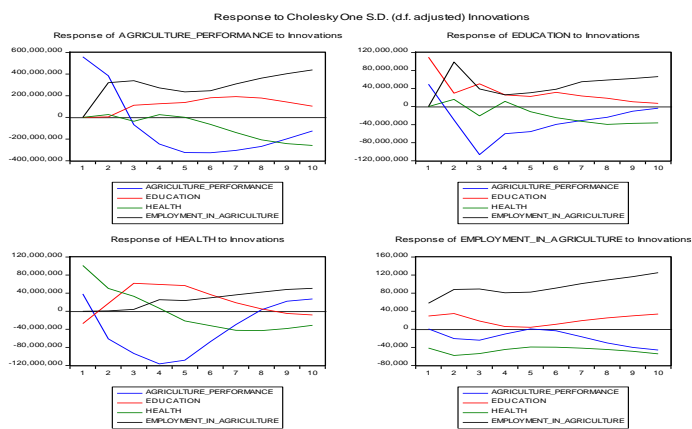
From the results of the Optimum lag test, it can be seen that the optimum lag is found in lag 1. The results of the Vector Autoregressive are shown in Table 5.

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

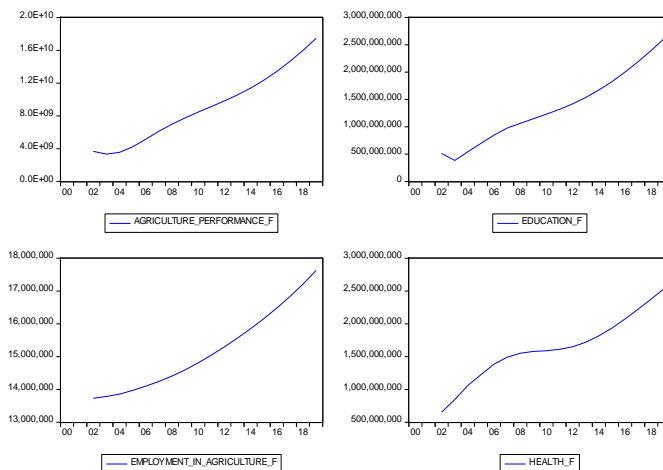
	AGRICULTURE_PERFORMANCE	EDUCATION	HEALTH	EMPLOYMENT_IN_AGRICULTURE
AGRICULTURE_PERFORMANCE(-1)	5.77E-01*	-1.17E-01*	-1.69E-01*	-3.62E-05*
	-3.70E-01	-7.93E-02	-7.38E-02	-5.10E-05
	[ 1.56046]	[-1.47596]	[-2.28627]	[-0.71183]
AGRICULTURE_PERFORMANCE(-2)	-6.68E-02*	5.43E-02*	-3.24E-02*	4.30E-05*
	-4.20E-01	-9.02E-02	-8.39E-02	-5.80E-05
	[-0.15905]	[ 0.60258]	[-0.38649]	[ 0.74461]
EDUCATION(-1)	-8.09E-01*	2.83E-02*	2.80E-01*	-7.61E-05*
	-1.61E+00	-3.45E-01	-3.21E-01	-2.20E-04
	[-0.50395]	[ 0.08200]	[ 0.87440]	[-0.34433]
EDUCATION(-2)	1.67E-01*	9.28E-02*	3.52E-01*	-1.47E-04*
	-1.31E+00	-2.80E-01	-2.61E-01	-1.80E-04
	[ 0.12793]	[ 0.33084]	[ 1.34896]	[-0.82035]
HEALTH(-1)	2.54E+00	8.58E-01*	5.04E-01*	5.41E-05*
	-1.51E+00	-3.23E-01	-3.01E-01	-2.10E-04
	[ 1.68271]	[ 2.65248]	[ 1.67528]	[ 0.26076]

HEALTH(-2)	-2.93E-01*	-1.78E-01*	2.87E-01*	1.51E-04*
	-1.42E+00	-3.06E-01	-2.84E-01	-2.00E-04
	[-0.20548]	[-0.58188]	[1.00923]	[0.77164]
EMPLOYMENT_IN_AGRICULTURE(-1)	5.55E+03	1.71E+03	1.40E+01	1.52E+00*
	-2.20E+03	-4.71E+02	-4.38E+02	-3.02E-01
	[2.52609]	[3.62544]	[0.03195]	[5.04663]
EMPLOYMENT_IN_AGRICULTURE(-2)	-4.44E+03	-1.34E+03	4.97E+02	-4.49E-01*
	-2.34E+03	-5.01E+02	-4.66E+02	-3.21E-01
	[-1.90161]	[-2.67018]	[1.06657]	[-1.39598]
C	-1.53E+10	-5.10E+09	-6.18E+09	-1.07E+06
	-1.50E+10	-3.30E+09	-3.10E+09	-2.10E+06
	[-1.00064]	[-1.55369]	[-2.02442]	[-0.50918]
R-squared	9.92E-01	9.82E-01	9.70E-01	9.98E-01
Adj. R-squared	9.85E-01	9.65E-01	9.44E-01	9.96E-01
Sum sq. resids	2.81E+18	1.30E+17	1.12E+17	5.33E+10
S.E. equation	5.59E+08	1.20E+08	1.12E+08	7.69E+04
F-statistic	1.36E+02	6.02E+01	3.68E+01	5.59E+02
Log likelihood	-3.82E+02	-3.54E+02	-3.53E+02	-2.22E+02
Akaike AIC	4.34E+01	4.04E+01	4.02E+01	2.56E+01
Schwarz SC	4.39E+01	4.08E+01	4.07E+01	2.61E+01
Mean dependent	9.24E+09	1.36E+09	1.62E+09	1.52E+07
S.D. dependent	4.49E+09	6.45E+08	4.72E+08	1.25E+06

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 0.985. 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 Tanzania 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 agricultural performance growth is not only in line with investment in education and health. But also, on employment in agriculture in Tanzania. This shows that Tanzania has succeeded in investing in education and health to improve agricultural performance as well as indicating that by improving human capital in Tanzania it increases employment, especially in the agricultural sector.

## 5 CONCLUSION

Agricultural performance growth is not only in line with investment in education and health. But also, on employment in agriculture in Tanzania. This shows that Tanzania has succeeded in investing in education and health to improve agricultural performance as well as indicating that by improving human capital in Tanzania it increases employment, especially in the agricultural

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