Employment Challenges in Agriculture in Australia

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Abstract : This research studies the relationship between agriculture and human capital using three key variables, namely agriculture performance as a basic indicator. Education investment as an indicator of human capital investment and employment in agriculture as a control indicator. This study uses vector analysis method as a basis for forecasting to understand the picture of agriculture and employment in Australia. We find that Australia has succeeded in successfully investing in education to improve agricultural performance. However, it is indicated that the interest of Australian citizens in the agricultural sector continues to decline and if no precautions are taken regarding this, it will threaten the Australian agricultural sector. Another effort that can be done is to automate the agricultural system so that it can improve agriculture with less manpower.

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

JEL Classification : C01,E24,J24, J43

1 INTRODUCTION

We can start by imagining that the extent of agricultural land in Australia is important. And so, agriculture and humans have been inextricably linked since the beginning of time, and in the case of Australia, since the days of British colonization.

Agriculture is a very important activity in the development of countries like Australia, where land expansion is enormous. Here, traditionally, wheat and cattle have dominated and still do today. It is true that much of Australia is arid, but not all, and Australians have gone to great lengths to install major irrigation systems that combat drought every day (Everingham et al,2015).

The distribution of agricultural production in Australia is largely determined by soil and climate (Ward et al,2021). Traditional systems of wheat farming and sheep production are fairly evenly distributed between parts of New South Wales, Victoria, South Australia, and Western Australia. Queensland, New South Wales, and Victoria produce most of the beef, and New South Wales has the largest and most numerous poultry farms. Large-scale sugarcane and vegetable production occurs almost exclusively in the tropical state of Queensland, while cotton is produced in New South Wales and Queensland. Tropical fruits such as mangoes and bananas are grown in parts of New South Wales, Queensland, Western Australia, and the Northern Territory.

2 LITERATURE REVIEW

As is well known, economists, economists, and politicians today, in principle, constantly debate human capital and its holders as the most important competitive advantage of companies. So about highly-skilled, loyal and motivated employees, the so-called modern "knowledge workers", which in the 21st-century modern management conditions as the "knowledge age" is the company's greatest wealth. And they were basically right about that. Unfortunately, this fact was never considered a systemic problem, but merely a kind of "business-organizational" problem. According to economic findings, very rapid and immediate tectonic changes have occurred in the objective socioeconomic conditions of the last few decades. Namely from the unstoppable side, shifting the focus on the importance of individual fundamental production factors for the creation of new values in the production process to classic ones (Widarni & Bawono, 2020).

Farms are still the best custodians of natural resources and also in the suburbs one of the most important, if not the most important landscape designer. In addition, agriculture provides employment for most of the population in the

rural part of the municipality (Liu, 2016).

Agriculture is an economic activity that has special social importance mainly because of its multifunctional role. The main task of agriculture in relation to food is to produce safe and quality food. In addition, agriculture has a significant impact on the quality of water, soil, air, and biodiversity, contributes to the image of the cultural landscape, and, through its economic and social role, on the vitality and population of rural areas (Bláha, 2019).

3 RESEARCH OBJECTIVE AND METHODOLOGY

This research begins by conducting a study of the factors that affect agricultural performance. We carry out factor understanding through research conducted previously through qualitative methods in each country. In general, there are two dominant factors that are generally accepted in every country that we have studied, namely the human factor in the form of a collection of skills, experience, and knowledge of humans who become workers in the field of agriculture, labor absorption in the field of agriculture or called work participation and non-human factors in the form of capital and equipment resources and technology availability. In this study, we focus on analyzing human capital which is significantly affected by education and government investment in education. So that it can be generalized that the encouragement of human capital development is in the form of state investment in education. This is a key factor of human capital development. The second key factor is work participation. Employment participation itself reflects the interest of citizens of productive age to work in the agricultural sector. And the last is the performance of the agricultural industry itself.

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.

Estimation using the VAR model requires all variables to be stationary at the level, if the variables are not stationary at the level, the estimation is carried out using the VECM model with the condition that all variables formed are cointegrated. The test is carried out in three stages, namely testing at the level, 1st difference, and 2nd difference. Each variable is tested starting at the level, if it is not stationary at this level it is continued at the 1st difference level, and if it is still not stationary it is continued to the 2nd difference level. Where in this study to test the stationarity of the data, the Augmented Dickey-Fuller test was used. One of the data stationarity is seen by comparing the alpha value with the probability value. When the probability value is below the alpha value, it can be said that the variable is stationary and vice versa. Because in this study using an alpha value of 5%, the variables that are declared stationary are only variables that have a probability value below the 5% alpha. Cointegration test 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 then the estimation is made using the vector autoregression (VAR) method.

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	EMPLOYMENT_IN_AGRICULTURE
Mean	2.51E+10	5.17E+10	3.71E+05
Median	2.49E+10	5.62E+10	3.66E+05
Maximum	3.59E+10	8.24E+10	4.67E+05
Minimum	1.30E+10	1.85E+10	3.20E+05
Std. Dev.	8.19E+09	2.23E+10	4.23E+04

Based on table 1 above, it appears that from the period 2000 to 2019, the average agricultural performance in Australia is very high at around 24.9 billion USD which can be seen from the mean value in table 1. with a high level of volatility at 8.19 billion USD. With an average number of workers 366 thousand people with an average educational investment value of 56.2 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. This book will also include a 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			7.00E+01	0
ADF - Choi Z-stat			-7.41E+00	0
Series	Prob.	Lag	Max Lag	Obs
D(AGRICULTURE_PERFORMANCE,2)	0.00E+00	0.00E+00	3.00E+00	17
D(EDUCATION,2)	0.00E+00	0.00E+00	3.00E+00	17
D(EMPLOYMENT_IN_AGRICULTURE,2)	0.00E+00	0.00E+00	3.00E+00	17

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 *	6.11E-01	3.22E+01	2.98E+01	0.0258
At most 1	4.97E-01	1.52E+01	1.55E+01	0.0546
At most 2	1.46E-01	2.85E+00	3.84E+00	0.0913

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 higher than the Trace Statistics value and the Max-Eigen Statistics value which shows that there is no 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 Autoregressive 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	-1.06E+03	NA	4.07E+47	1.18E+02	1.18E+02	1.18E+02
1	-1.03E+03	44.24893*	4.80e+46*	115.9789*	116.5725*	116.0608*
2	-1.03E+03	3.12E+00	1.09E+47	1.17E+02	1.18E+02	1.17E+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

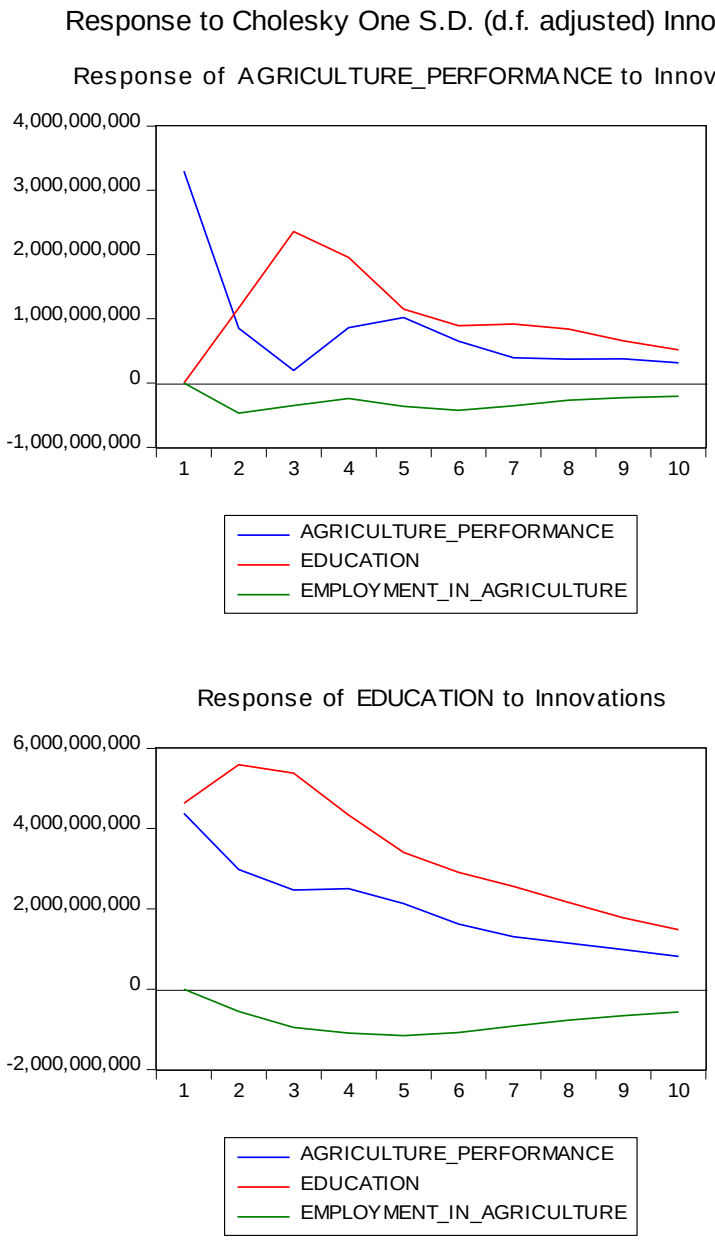
From the results of the Optimum lag test, it can be seen that the optimum lag is found in lag 1. The results of the Vector Autoregressive estimation are shown in Table 5.

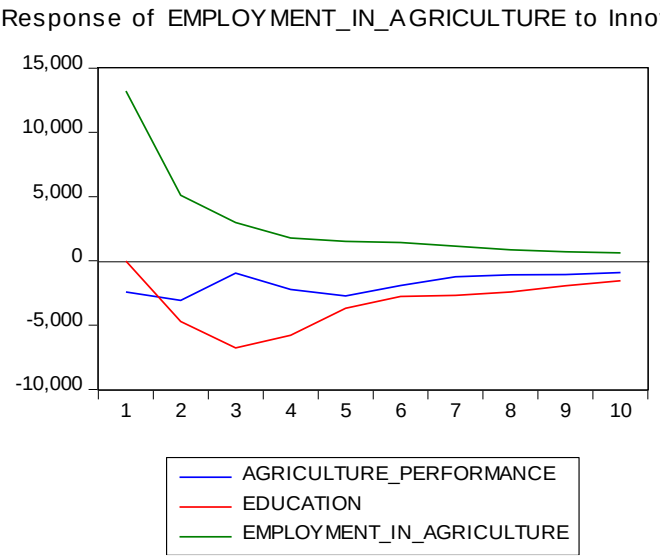
Table 5. The results of the Vector Autoregressive estimation

	AGRICULTURE_PERFORMANCE	EDUCATION	EMPLOYMENT_IN_AGRICULTURE
AGRICULTURE_PERFORMANCE(-1)	-1.03E-01	-7.31E-01	7.02E-07
	-4.03E-01	-7.78E-01	-1.60E-06
	[-0.25651]	[-0.93943]	[0.42805]
AGRICULTURE_PERFORMANCE(-2)	-4.37E-01	-1.31E-02	8.76E-07
	-4.40E-01	-8.49E-01	-1.80E-06
	[-0.99346]	[-0.01544]	[0.48894]
EDUCATION(-1)	2.53E-01	1.21E+00	-1.02E-06
	-2.06E-01	-3.97E-01	-8.40E-07
	[1.22784]	[3.03983]	[-1.21714]
EDUCATION(-2)	1.94E-01	-1.54E-01	-1.47E-08
	-2.22E-01	-4.29E-01	-9.00E-07
	[0.87282]	[-0.35886]	[-0.01626]
EMPLOYMENT_IN_AGRICULTURE(-1)	-3.55E+04	-4.19E+04	3.86E-01
	-5.79E+04	-1.12E+05	-2.36E-01
	[-0.61414]	[-0.37498]	[1.63478]
EMPLOYMENT_IN_AGRICULTURE(-2)	-5.77E+03	-3.15E+04	5.87E-02
	-5.32E+04	-1.03E+05	-2.17E-01
	[-0.10854]	[-0.30618]	[0.27091]
C	3.20E+10	4.58E+10	2.12E+05
	-2.20E+10	-4.30E+10	-9.07E+04
	[1.43984]	[1.06490]	[2.33389]
R-squared	8.75E-01	9.37E-01	8.57E-01
Adj. R-squared	8.07E-01	9.03E-01	7.79E-01
Sum sq. resids	1.20E+20	4.47E+20	1.99E+09
S.E. equation	3.30E+09	6.37E+09	1.34E+04
F-statistic	1.28E+01	2.75E+01	1.10E+01
Log likelihood	-4.16E+02	-4.27E+02	-1.92E+02

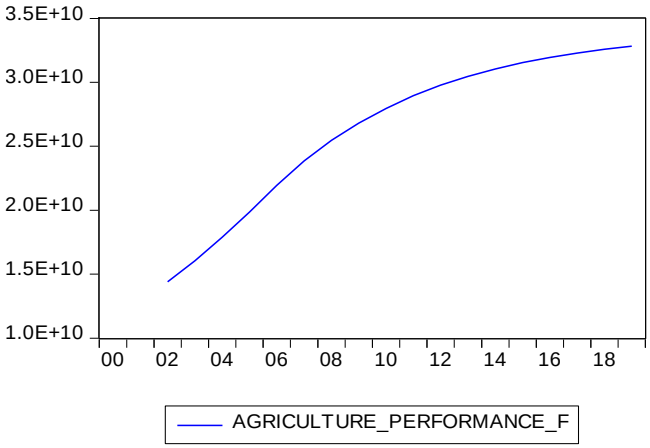
Akaike AIC	4.70E+01	4.83E+01	2.21E+01
Schwarz SC	4.73E+01	4.86E+01	2.25E+01
Mean dependent	2.64E+10	5.53E+10	3.60E+05
S.D. dependent	7.50E+09	2.05E+10	2.86E+04

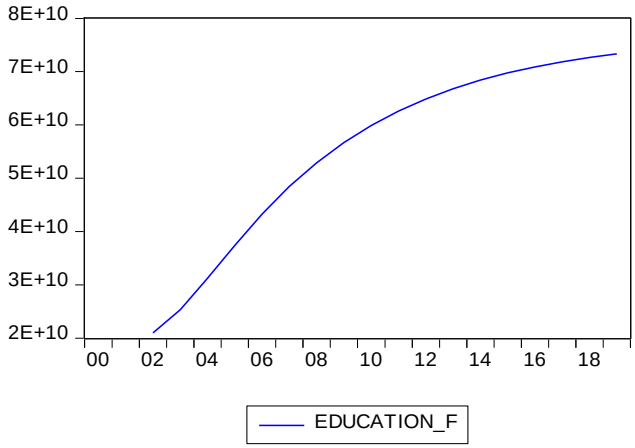
Based on the results of the estimated output, it can be indicated the direction of the relationship, and the significance of each variable and each period. Negatively related variables are marked (-). Significant relationships are marked with a sign (*). The value of the coefficient of determination (Adj. R-Square) shows the degree of truth of the estimate of 0.875. This means 87.5% 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 Australia 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 investment in Australia. This indicates that Australia has succeeded in successfully investing in education to improve agricultural performance. However, it is indicated that the interest of Australia citizens in the agricultural sector continues to decline and if no precautions are taken regarding this, it will threaten the Australia agricultural

sector. Another effort that can be done is to automate the agricultural system so that it can improve agriculture with less manpower.

5 CONCLUSION

Australia has succeeded in successfully investing in education to improve agricultural performance. However, it is indicated that the interest of Australia citizens in the agricultural sector continues to decline and if no precautions are taken regarding this, it will threaten the Australia agricultural sector. Another effort that can be done is to automate the agricultural system so that it can improve agriculture with less manpower.

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