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Article

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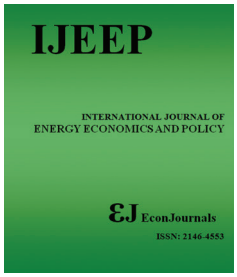
International Journal of Energy Economics and Policy

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Duyen Dang Thi Thuy (2023). Energy and agricultural development in the Red River Delta provinces, Vietnam. In: International Journal of Energy Economics and Policy 13 (4), S. 216 - 224. https://www.econjournals.com/index.php/ijeep/article/download/14337/7391/33821. doi:10.32479/ijeep.14337.



International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2023, 13(4), 216-224.

Energy and Agricultural Development in the Red River Delta Provinces, Vietnam

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Received: 11 March 2023 **Accepted:** 14 June 2023 **DOI:** https://doi.org/10.32479/ijeep.14337

ABSTRACT

Agriculture is a traditional industry in Vietnam in general and the Red River Delta in particular. Agriculture has created many jobs and incomes for laborers in the locality and neighboring provinces over the past time. However, the production and consumption of energy such as gasoline, gas, petroleum and fuel in the Red River Delta are concerned and focused by local authorities and people. In particular, they emphasize green agriculture. This study investigates the long-term cointegration relationship between energy production and consumption on agricultural development and local economic growth. The author used long-term data of eleven provinces for calculation. The experimental results demonstrate that the independent variables explain 53.5% of the variation of the dependent variable and the rest (46.5%) can be explained by other causes. The research results show that 4 factors are agricultural labor (La), agricultural revenue (output) (REV), agricultural investment capital (Ia) and production and consumption of petroleum and gas (PE) has a positive impact on agricultural production value. The factor of energy production and consumption (EG) has a negative impact on the value of agricultural production in the Red River Delta. From there, the study proposes ways to use more efficiently the existing energy sources in the Red River Delta.

Keywords: Agriculture, Petroleum, Energy, Sustainable Development
JEL Classifications: Q56, Q57, R11

1. INTRODUCTION

When it comes to Vietnam's economy, it's about agriculture. Agriculture not only creates jobs, income and output, but also spreads the development of industry and community tourism. (Nguyen and Nguyen, 2022; Nguyen and Huynh, 2021). Climate, weather and soil have all supported the development of Vietnamese agriculture for thousands of years (Le et al., 2022; Nguyen et al., 2021). Agriculture is also an important economic sector for many countries (Soetriono et al., 2020), especially in developing countries like Vietnam, where agriculture plays a significant role in the livelihoods and employment of about 40% of the population, (General Statistics Office, 2019). The Red River Delta (or the Northern Delta) is the downstream area of the Red River and Thai Binh River in Northern Vietnam. The Red River Delta (or the Northern Delta) is the downstream area of the Red River and Thai Binh River in the North of Vietnam. The Red River Delta includes 11 provinces (according to economic zone planning, 2013). In terms of natural conditions and natural resources: The terrain is low and the area is mostly plain, quite flat, which is very favorable for the development of all economic sectors and population concentration. Most of the land is alluvial soil of the Red and Thai Binh river systems. This is one of the factors creating favorable conditions for the development of agriculture in the region. Agriculture in the Red River Delta is facing many risks such as: Shrinking farming area due to urbanization, shortage of human resources, climate change and market competition from free trade agreements. The Red River Delta is less likely to expand the area of land to be used for agricultural production. This is also a key area of the Northern economy, so the demand for land for non-agricultural fields and urban development is very large. So, the land taken is mainly agricultural land. In the period 2005-

2015, the area of agricultural land in the region decreased by 14.5 thousand hectares, mainly in the group of annual crops, especially the area for rice cultivation. In addition, Bac Ninh Statistical Office (2021) indicated a huge contribution of agricultural products in the economic development at present.

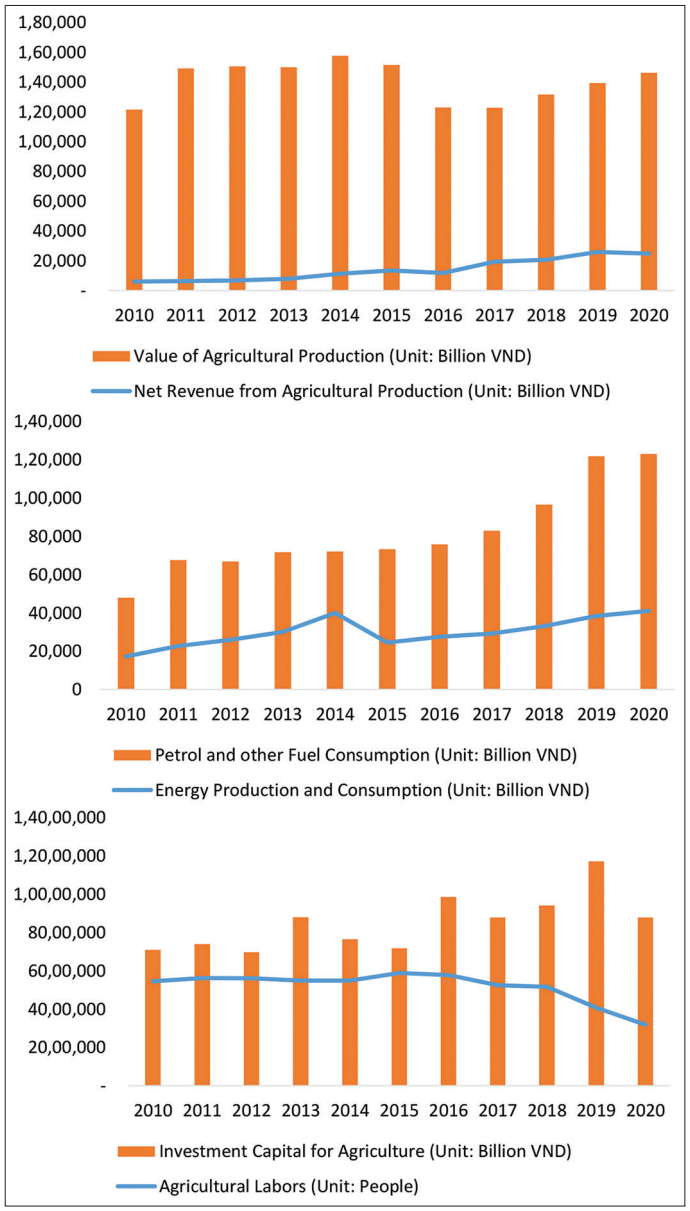
According to the national plan, by 2020, the total agricultural land area of the whole Red River Delta region will be 906.9 thousand hectares, accounting for 60.6% of the total natural area and a decrease of 41.0 thousand hectares compared to 2010. Agricultural production land fluctuates quite a lot. By 2020, the size of the area will decrease by 59.2 thousand hectares, of which the land for annual crops will decrease by 71.3 thousand hectares and the land for rice cultivation by 78.4 thousand hectares (Ministry of Education and Training, 2021).

According to local authorities, the changes in agricultural land in the Red River Delta in the past time and in the future will mainly follow the following directions: (1) Loss of agricultural land due to urban development, construction of industrial parks industry, services, construction of infrastructure such as traffic, irrigation, development of urban areas and services. (2) Transition from less efficient land to more efficient use. (3) Using agricultural land more rationally, efficiently and sustainably. Therefore, sustainable agricultural development in the Red River Delta should be considered as one of the important solutions for sustainable economic development. The green economy development in the agricultural sector not only contributes to the rational, economical and efficient use of natural resources, energy sources, and environmental protection, but also changes the production and consumption structure use. That brings economic efficiency, creates more jobs and improves people's living standards.

Similar to the development of other economic regions in the country, the Red River Delta also focuses on developing industries and services. Therefore, agriculture also tends to decrease in both size and contribution to the local economy as shown in Figure 1:

Agricultural production value and net revenue both tend to increase, averaging over 10% per year in the period 2010-2019. In 2020, due to the impact of covid 19, most development indicators will decrease. Labor participation in agriculture tends to decrease over the years and this is also the general development plan of the provinces in the region. Agricultural land decreased, but investment capital for agriculture tended to increase in the period of 2010-2019 (average 6%/year).

Figure 1: Energy consumption and agriculture data in the Red River Delta



Source: GSO, 2020

2. METHODOLOGIES

2.1. Theories

Both quantity and quality of labor have a strong impact on output for the economy (Nguyen et al., 2020). A labor development strategy with a specific job at a specific labor site will be the growth potential for that industry, Solneta et al. (2014). Increasing population and labor have both positive and negative impacts on the economy in general and the economic sector in particular. When the education system, living standards and quality of life of the people are improved, the population change in both quantity and quality contributes greatly to economic development (Mohsen and Chua, 2015). Population growth can lead to continuous economic growth, which is associated with improving the quality of life and education level for people, especially those of working age who participate in the labor market, Golley and Wei (2015). For developing countries, implementing a population policy to reduce the birth rate in order to reduce the population can have a negative effect of restricting growth (Dao, 2012). Population, labor, land, machinery, fertilizers. affect output (agricultural revenue) from which it affects economic growth. Agricultural output and agricultural labor productivity also affect the factor TFP. Through collecting data on population and land, the author looks at China's agricultural economy and agricultural output in the long run, Zhai and Loub (2022). With the new dataset, the authors clarify agricultural growth from the beginning of the Qing dynasty to the present era (1661-2019).

Edeme et al. (2020), the author studied the impact of infrastructure development on agricultural output and employment in the Economic Community of West African countries. Research shows that infrastructure that supports agricultural productivity drives job creation. The estimated results show that information and communication technology has a positive influence on agricultural output. While access to electricity has a positive impact on agricultural employment. Transport infrastructure has a negative but insignificant impact on agricultural performance. Agricultural output has impacted the economic growth of these countries. Hang (2020), In developing countries, the agricultural productivity gap, namely the ratio of labor productivity in the non-agricultural sector to labor productivity in agriculture is much larger if measured by total output relative to value added.

Capital and fixed assets are one of the important factors contributing to the economic growth of agricultural countries (Siregar and Widjanarko, 2022). The formation of fixed capital (fixed assets) can boost economic growth by 3.32%. The study investigates the impact of many factors including fixed capital (GFCF) and population of 72 agricultural countries on their economic growth. From 2011 to 2020, the value of the GFCF was US$2,859.04 billion and it increased 19% to US$3,393.73 billion. The population tends to increase continuously year by year and over 72 countries have experienced in exporting plus importing which has increased their GDP beyond their expectations. The increase in GFCF and population both stimulate economic growth in these countries. In the same opinion, Belloumi and Alshehry (2018) believes that fixed asset value has a positive impact on growth both in the short and long term. Fixed assets also help businesses strengthen their positions, maintain business cycles and grow steadily (Rehman and Hysa, 2021). When stable growth can improve the policy system, finance promotes investment. As such, fixed asset value can positively impact growth by promoting and increasing investment (Rinosha and Mustafa, 2021).

Social capital makes an important contribution to the operation of agricultural enterprises (Zhou et al., 2022). The greater the investment capital is, the more competitive advantages, corporate social responsibility and success in agribusiness is. Ensuring sufficient production capital in agriculture is the top concern of agricultural enterprises in the current period of disease prevention and control (Pham and Tran, 2022). In rural areas, capital plays an even bigger role. Investment capital both helps to promote the agricultural economy and modernizes rural areas (Baba et al., 2010). In the early stages of development, investment capital and labor determine the agricultural growth rate in Can Tho (Vietnam), but in 2019, investment capital and technology play an important role (Nguyen and Huynh, 2021). Zhaoxing et al. (2022), the purpose of the author's study is to examine the structural links between social responsibility, social capital, competitive advantage and performance of agricultural enterprises in China. This study focuses on the role of social capital and competitive advantage in business performance. According to the results of the mediation effect test, social capital and competitive advantage become mediators in the relationship between corporate social responsibility and business success. By revealing the role of social capital and competitive advantage in mediating the relationship between corporate social responsibility and business performance, it has helped agribusinesses find management solutions. Zou and Li (2022) also agreed to appreciate the role of investment capital in economic development. But in a specific case, Fanqi and Tinghui (2022) consider the role of agro-ecological investment in green circular economy development. However, the impact of active investment and passive investment on green circular economy is different. But the research results agree that agro-ecological investment has a positive impact on economic development.

Inumula et al. (2020), empirically examines the relationship between agricultural economic growth and energy consumption in India based on annual time series data for the period 1985-2017. The study is based on four economic indicators namely agricultural value added (base year USD 2010), energy expenditure (GWh), agricultural gas consumption (mmcft) and agricultural oil consumption (tonnes) in India. Value added in agriculture is a financial option to benefit the development of agriculture. Energy expenditure is represented by agricultural electricity consumption. Daizy et al. (2021), evaluates the long-term dynamic relationship between agricultural value and carbon emissions and phenomena such as globalization, industrialization, and electricity consumption in Bangladesh. The study uses annual time series data for the period 1971-2014. The results show a strong positive long-term relationship between carbon emissions, globalization and electricity consumption while the relationship between emissions and industrialization is weak. Pei et al. (2016) examines the impact of electricity consumption on three sectors, namely manufacturing, agriculture and service. The results found that there is a long-term relationship between electricity consumption and three sectors in Malaysia. Granger causality is used. The results show that electricity consumption does not cause Granger causality for the manufacturing and service sectors. However, the consumption of electricity causes Granger causality for the agricultural sector.

Kwakwa (2012) examines the causal relationship between decoupled energy consumption (electricity and fossil fuel consumption) and economic growth, agricultural and production growth in the Ghanaian economy over the period 1971-2007. Using granger causality for research indicates a one-way causal relationship from overall growth to electricity and fossil consumption. It shows a unidirectional causality from agriculture to electricity consumption both in the short and long term and a feedback relationship between electricity production and consumption. Energy does not appear to be the decisive factor of production in the agricultural sector, but it is important in the manufacturing sector. Therefore, efforts should be directed towards ensuring a high energy supply to the manufacturing sector in order of maintaining the sector's contribution to the economy.

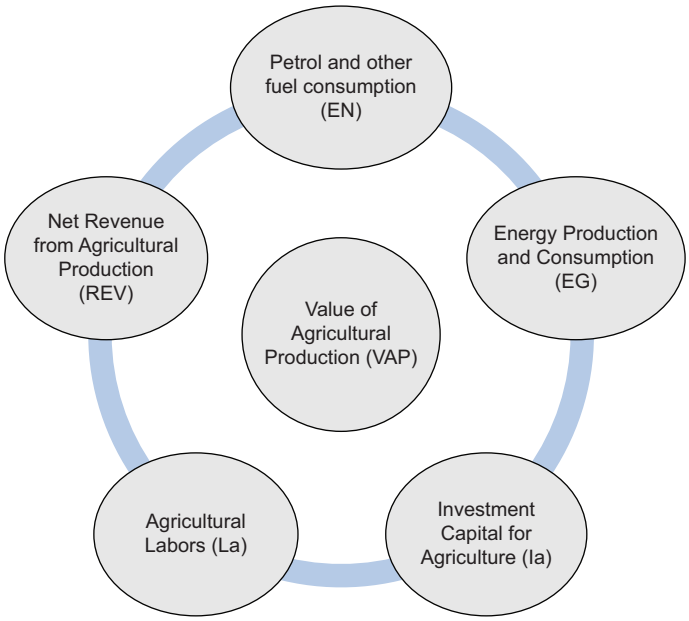
Khalid et al. (2020) argues that electric power plays an important role as a driver of economic growth, especially in developing countries. The author's long-term estimation results indicate that electricity consumption shows a significantly positive relationship to economic growth. The findings of this paper suggest that Sudan's economy takes advantage of boosting electricity production for national economic growth. Therefore, policies to support and encourage the development of electricity

for efficient use are essential. Nguyen et al. (2020), as well as Long (2020) foreign direct investment and raw materials (e.g. coal, electricity, gas and oil) are important inputs to economic growth. Through the Bayesian approach, the author revisits the impact of foreign direct investment, electricity consumption and urbanization on economic growth in six ASEAN countries from 1980 to 2016. The obtained results show that the impact of electricity consumption is clear and positive on economic growth in both regular and Bayesian inference. The author used Bayesian inference to provide evidence that foreign direct investment has a certain impact on economic growth of countries. Empirical results from Bayesian inference contribute to the literature on foreign direct investment patterns and emphasize the significant importance of attracting foreign direct investment more effectively and achieving long-term sustainability. It's also about understanding the agriculture-energy relationship, but it's about carbon emissions efficiency. Research by Tian et al. (2023) shows that carbon emissions efficiency in China is increasing (average 4.82%/year) from 2005 to 2020. To get such impressive results there is an impact dynamics of technical efficiency improvement. In particular, technological innovation has also boosted rural energy carbon productivity in many provinces of China. The study also shows that the efficiency of rural energy carbon emissions also has a positive impact on the level of agricultural development, the structure of the labor force and the degree of urbanization. Besides the positive impact factors, there are also negative impacts on carbon emission efficiency such as the structure of arable land use, human capital and consumption level of rural residents. In addition, Bjarsti and Sandstrom (2016) indicated the important role of public private partnership in the rural area and its impact on achieving sustainable rural development.

2.2. Model Building and Research Methods

Based on the survey of related documents as well as previous research, the author proposes a research model as shown in Figure 2.

Figure 2: Proposed research model



The model to analyze the impact of energy production and consumption on agricultural production value in the Red River Delta is based on data sources, which are: Number of agricultural workers (La), Investment capital for agriculture (Ia), Revenue (output) of agricultural production (REV), Production of petroleum and fuels (EN) and Production and consumption of energy (EG). The data collected and calculated for eleven provinces are Bac Ninh, Ha Nam, Hanoi, Hai Duong, Hai Phong, Hung Yen, Nam Dinh, Ninh Binh, Thai Binh, Vinh Phuc, and Quang Ninh.

$$ln\_VAP_{it} = \beta_1 + \beta_2\, ln\_La_{it} + \beta_3\, ln\_REV_{it} + \beta_4\, ln\_Ia_{it} + \beta_5\, ln\_PE_{it} + \beta_6\, ln\_EG_{it} + u_{it}$$

i: 11 provinces 1,2.11
t: Year (from 2010 to 2020)

2.2.1. Research hypothesis

H_1: Labor working in agriculture has a positive impact on agricultural production value
H_2: Agricultural revenue (output) has a positive impact on agricultural production value.
H_3: Agricultural investment has a positive impact on agricultural production value.
H_4: Consumption of petrol and gas has a positive impact on the value of agricultural production.
H_5: Energy production and consumption have a negative impact on agricultural production value.

The research data used were obtained from different sources, mainly from the statistical yearbooks of eleven provinces. In addition, the author also consulted and took from articles, book chapters, projects, and other scientific research topics

2.2.2. Description of the model variable

Variable number of employees in agricultural enterprises (La): Collected in the area (provinces), using interval scale, unit: Person.

Variable agricultural revenue (output) (REV): Collected in the area (provinces), using the interval scale, unit: billion VND.

Variable investment capital for agriculture (Ia): Collected in the area (provinces), using the interval scale, unit: Billion VND.

Variables of production and consumption of petrol and gas (PE): Collected in the area (provinces), using an interval scale, unit: billion dong.

Variable Energy Production and Consumption (EG): collected in the area (provinces), using the interval scale, unit: billion VND. In addition, the descriptive statistics of variables will be shown in Table 1 as follows:

3. RESULTS

The author sets up a matrix of correlation coefficients showing the degree of interaction of independent variables with each other. Based on the correlation analysis table in Table 2, it shows that

all independent variables can be included in the model and ensure that the model does not have multicollinearity.

The results are performed with the help of stata software. Regression between the dependent variable and the variables: Number of employees in agriculture (La), number of agricultural revenue (output) (REV), Agricultural investment capital (Ia), production and consumption petroleum, gas (PE) and energy production and consumption (EG). Table 3 shows that sig test t-regression coefficients of the independent variables are all <0.05, so the independent variables are significant to explain the dependent variable, no variable is excluded from the model. Sig test F is equal to 0.000 < 0.05, so the multiple linear regression model fits the data set and can be used.

The sig value of the F test was used to test the fit of the regression model. If sig is <0.05, we conclude that the multiple linear regression model fits the data set and can be used. This value is usually in Table 3.

Table 4 shows that the adjusted R2 value of 0.535 shows that the independent variable included in the regression affects 53.5% of the change of the dependent variable, the remaining 47.5% is due to variables outside the model and random error (Figure 3).

Figure 3 shows that the mean Mean is 1.11E-15 approximately =0, and the standard deviation Std. Dev = 0.979 is approximately = 1, further confirming that the normalized residuals follow a normal distribution. Therefore, it can be concluded that the assumption of the normal distribution of the residuals is not violated (Figure 4).

Table 1: Descriptive statistics of variables by stata software

Variable	Obs	Mean	SD	Minimum	Maximum
ln_VAP	121	9.25774	0.5823458	8.402894	10.73387
ln_La	121	8.090614	0.9076199	6.700731	10.03228
ln_REV	121	6.609304	1.0593	4.385657	9.062536
ln_Ia	121	6.803925	0.8025539	4.442675	8.824972
ln_PE	121	8.1452	1.115912	5.81144	11.00031
ln_EG	121	6.822369	1.56443	4.59144	9.813938

Source: Regression Results on Stata 14. SD: Standard deviation

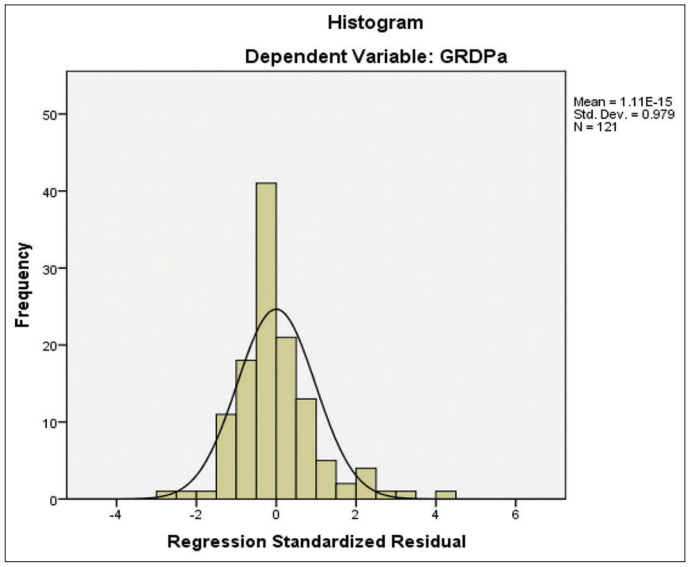
Table 2: Matrix of correlation coefficients

Item	ln_AV	ln_La	ln_Ia	ln_PE	ln_EG
ln_La	1.0000				
ln_REV	0.5572	1.0000			
ln_Ia	0.3420	0.3862	1.0000		
ln_PE	0.5715	0.6741	0.2476	1.0000	
ln_EG	0.4004	0.3692	−0.0609	0.6989	1.0000

Source: Regression Results on Stata 14

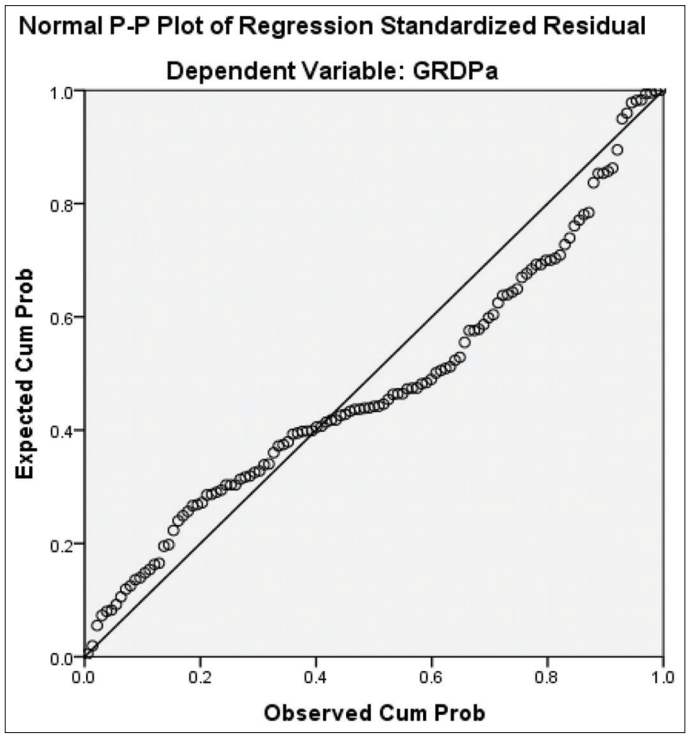
Figure 4 shows the percentiles in the distribution of the residuals are concentrated in a diagonal, so the assumption of the normal distribution of the residuals is not violated.

Figure 3: Percentage points



Source: SPSS 20

Figure 4: Residual



Source: SPSS 20

Table 3: Model fit test

ANOVA[a]					
Model-1	**Sum of squares**	**df**	**Mean square**	**F**	**Significant**
Regression	6042758957.145	5	1208551791.429	26.481	0.000[b]
Residual	5248458456.767	115	45638769.189		
Total	11291217413.911	120			

[a]Dependent variable: VAP, [b]Predictors: Constant, PE, EG, La, Ia, REV. Source: SPSS 20

All correlation coefficients are <3 indicating that multicollinearity is not serious (Table 5). That shows that independent variables can be used to estimate the model.

Table 6 shows the estimated regression:

$$ln\_VAP_{it}=4.62 + 0.349\ ln\_La_{it} + 0.108\ ln\_REV_{it} + 0.183\ ln\_Ia_{it} + 0.216\ ln\_PE_{it} - 0.071\ ln\_EG_{it}$$

3.1. Regression Model Results

The regression coefficients of ln_La, ln_REV, ln_Ia, ln_PE are >0, and ln_EG is <0. Thus, the independent variables ln_La, ln_REV, ln_Ia, ln_PE included in the regression analysis all have the same effect on the auxiliary variable. Dependent, while the variable ln_EG has the opposite effect on the dependent variable. Based on the size of the normalized regression coefficient Beta, the order of influence is from the strongest to the weakest of the independent variables to the dependent variable. Our final model is a log-log model, with both dependent and independent variable appearing as logs:

This is interpreted as a 1% increase in La results in a 0.35% increase in VAP. Therefore, for a 1% increase in La we would expect VAP to rise by 0.35%. Labor variables have a great impact on agricultural growth in particular and the local economy in general. The Red River Delta has a tradition of farming, most of the laborers are involved in agricultural production (both directly and indirectly). In recent years, the agriculture of the provinces in the region has also attracted laborers from neighboring provinces. The living standard of agricultural workers also increased significantly in terms of income and spiritual life (Department of Agriculture and Rural Development of provinces, 2020). Increasing the number of workers can have a positive impact on economic growth and the agricultural economy. This impact is very significant on growth in the long run. This conclusion is consistent with many studies such as Dao (2012) and Golley and Wei (2015). The income of workers has also gradually improved. The quality of labor increases, which is also an important factor in assessing the role of labor in agriculture, Tao (2004).

For PE - For each, 1% increase in PE, VAP increases on average by 0.2161%. Therefore, for a 1% increase in La we would expect VAP to rise by 0.22%. That is, at present, petroleum and other fuels have a positive impact on local agricultural growth. The variable PE has the same effect as the dependent variable VAP which is also quite reasonable. Currently, the Red River Delta uses a lot of industrial machinery for agricultural production. Machinery engines mainly use gasoline as fuel to operate. With traditional manual labor has been replaced by machines and technology, this has increased labor productivity in the Red River Delta. As a result of production, agricultural revenue increased rapidly (Figure 1) and contributed to agricultural growth very significantly. (Department of Agriculture and Rural Development of provinces, 2020). Agricultural labor decreased in number, agricultural land also decreased in area. To maintain and increase production, many machines and technologies must be used. The use of machinery in the early stages of development in a developing country like Vietnam, the consumption of a lot of gasoline and fuel for production is inevitabl, Islam et al. (2017).

For Ia - for each, 1% increase in Ia, VAP increases on average by 0.183%. Therefore, for a 1% increase in Ia we would expect VAP to rise by 0.183%. Investing in agriculture requires long-term, large risks and especially related to nutrition and health. It requires that before investing, investors must choose a location carefully about suitable soil, climate, plant varieties and livestock. From there, we can create specific and unique products in agriculture and create a solid competitive position. However, most of the current agricultural investment in the RRD is domestic capital from the government, business and private sector. Domestic capital is still largely state capital (Department of Agriculture and Rural Development of provinces, 2020).

For REV - for each, 1% increase in REV, VAP increases on average by 0.11%. Therefore, for a 1% increase in REV we would expect VAP to rise by 0.11%. When the output and revenue of agricultural production increase, the added value in agriculture increases. However, the added value of the agricultural sector still has a low contribution to the overall economic growth of the

Table 4: Model summary

Model summary[b]					
Model	R	R^2	Adjusted R^2	SE of the estimate	Durbin-Watson
1	0.732[a]	0.535	0.515	6755.6472	1.726

SE: Standard error

Table 5: Testing for multicollinearity

Variable	VIF	1/VIF
ln_PE	3.43	0.291131
ln_EG	2.26	0.442028
ln_REV	2.16	0.462183
ln_La	1.69	0.590086
ln_Ia	1.35	0.741148
Mean VIF	2.18	

Source: Regression results on Stata 14

Table 6: Results of multiple linear regression analysis

Model-1	Unstandardized coefficients		Standardized coefficients (β)	T	Significant
	B	SE			
Constant	4.62161	0.3865065	3.856015	11.96	0.000
ln_La	0.3491024	0.0502904	0.2494868	6.94	0.000
ln_REV	0.1083915	0.0486879	0.2048329	2.23	0.028
ln_Ia	0.1834349	0.0507481	0.0829127	3.61	0.000
ln_PE	0.2165211	0.0582334	0.101172	3.72	0.000
ln_EG	−0.0708867	0.0337105	−0.1376608	−2.10	0.038

Source: Regression RESULTS on Stata 14. SE: Standard error

locality (Department of Agriculture and Rural Development of provinces, 2020).

For EG, an increase in EG by a percent leads to a decrease in VAP of 0.07%. Energy production such as electricity, gas, etc. has a negative impact on agricultural production. This also reflects the policy of Vietnam in general and the Red River Delta regions and localities in particular in promoting agricultural development towards green agriculture, less dependent on energy generating CO_2 emissions. One of the policies that the Red River Delta offers is to reduce the use of energy that is harmful to the environment, contributing to the sustainable development of the local economy. Agricultural land in the Red River Delta mainly grows wet rice, and vegetables. Land area tends to decrease over time. Orientation for agricultural development in the Red River Delta must be towards organic agriculture and green agriculture, Tran and Vu (2019). This is not only to increase output and revenue for the industry, but also to create tourist attractions to attract tourists. At the same time, the provinces have both exploited agricultural products and formed a space for tourists to experience the countryside.

4. DISCUSSION AND CONCLUSION

The research results show that, in the long term, there are four factors that positively affect the revenue of agricultural enterprises in descending order, namely labor, petrol, capital and revenue (output). When labor changes 1%, agricultural production value is 0.35%, gasoline fuel increases 1%, agricultural production value increases 0.0.22%, investment attraction increases 1%, production value increases. Agriculture increased by 0.18% and agricultural output increased by 1%, the value of agricultural production increased by 0.11%. But when the production of energy such as electricity, gas. increases by 1%, the value of agricultural production decreases by 0.07%. Therefore, according to the author, the Red River Delta provinces need to pay attention to some issues:

Firstly, it is necessary to improve the quality of human resources in agriculture. Labor participation in the agricultural sector has tended to decrease recently (GSO, 2020). The reason is that agricultural land is reduced and labor is replaced by machines. Statistics from the General Statistics Office from 2009 to 2019 also show that there is a shift in the structure of agricultural labor in the total number of employees towards a decreasing trend. Labor working in the agricultural sector decreased continuously from 2009 to 2019, from 54% to 35% respectively (Provincial statistics bureau, 2021. With the number of agricultural workers decreasing, it is necessary to employ effectively train and re-train the local agricultural labor force. Career orientation and career guidance with practical experience at training places (such as: educational institutions, training enterprises) should be maintained and developed, Vu et al. (2019).

The government creates favorable conditions for a team of well-trained and dedicated teachers to be ready to work at training institutions in agriculture and rural areas, especially young teachers. There are policies to give priority to subjects studying majors serving agriculture and rural areas. Policies on scholarships and tuition fees such as tuition fee exemption and reduction, scholarship increase. This is in order to solve the difficult situation of enrollment in training institutions specializing in agriculture. At the same time, it is necessary to create conditions for rural children to have more opportunities to study.

It is necessary to strengthen training and fostering knowledge of advanced and modern production techniques for farmers through measures such as: (1) Promote socialization and enhance the role of social organizations, unions, etc. vocational training for rural workers. (2) Enhance educational activities and transfer technical advances and scientific applications to farmers (3) Improve labor productivity, quality of agricultural products and income for farmers (4) Building effective vocational training models for rural workers in each industry and field for replication (5) Pilot building online courses for rural workers (6) Build digital resources to create favorable conditions for employees to participate in vocational training. Thereby, it is possible to take advantage of local agricultural labor.

It is necessary to step up investment portfolios, programs and projects on career development and regular job creation for rural workers. Since then, an advanced workforce has been built, who have both expertise, skills and digitalisation.

Secondly, it is necessary to diversify energy sources for agricultural production. Clean energy sources from water, sun, wind. can be utilized to serve not only agriculture but also other economic sectors. It is necessary to make use of sunlight energy for drying agricultural products, arrange light-filled doorways for the lighting of workshops and barns, arrange air intakes and indoor ventilation in a reasonable manner. These allow the best air circulation for the product to reduce production costs and avoid the use of electrical lighting equipment.

Thirdly, the provinces should focus on attracting investment capital for the asset system, high technology for agriculture in both quality and quantity. Currently, the general policy of our state and provinces should promote the development of high-tech agriculture. Agriculture needs to apply more machinery and equipment, science and technology and smart technology to have clean, high-quality and high-yield agricultural products. Invest in upgrading equipment suitable for the production process, equipment use, clean energy technology, renewable energy in production, processing, processing, preservation and transportation of agricultural products. Eliminate agricultural equipment and machinery with outdated technology and low energy efficiency.

Provinces should diversify sources of investment capital for agriculture. Investment in agriculture requires not only state capital, but also capital mobilization from businesses and individual investors. It is necessary to improve mechanisms and policies to support and create a favorable environment to attract businesses and private investors to invest in agricultural, forestry and fishery production in rural areas. The entire population needs to raise awareness of the importance of calling for FDI in the agricultural sector. It is necessary to have policies to encourage

FDI investment in the industry such as policies for infrastructure development, tax, credit and human resource development (Salahuddin et al., 2018). At the same time, it is necessary to improve the quality of investment promotion in an effective and synchronous manner. The agricultural sector continues to give priority to calling foreign investors in agricultural production in the direction of high-tech application, sustainable development and in the form of public-private partnership.

Fourthly, it is necessary to improve labor productivity for the agricultural sector. The research and application of science to agriculture is extremely important. That helps agriculture increase labor productivity, output and revenue. Government and local budgets need to pay more attention to research, deployment and application of technology for agriculture. Prioritize topics with high application in agriculture. Localities need to attract and reward researchers specialized in agriculture.

Finally, the provinces need to move towards the development of green and environmentally friendly agriculture. Products of the fisheries, farming and livestock industries ensure food safety, meet domestic demand and export to international markets. At the same time, it is necessary to limit the use of energy that pollutes the water, air and soil environment.

REFERENCES

Baba, S.H., Saini, A.S., Sharma, K.D., Thakur, D.R. (2010), Impact of investment on agricultural growth and rural development in Himachal Pradesh: Dynamics of public and private investment. Indian Journal of Agricultural Economics, 65(1), 1-24.

Bac Ninh Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Bac Ninh Statistical Office.

Belloumi, M., Alshehry, A. (2018), The impacts of domestic and foreign direct investments on economic growth in Saudi Arabia. Economies, 6(1), 18.

Bjarstig, T., Sandstrom, C. (2016), Public-private partnerships in a Swedish rural context-a policy tool for the authorities to achieve sustainable rural development. Journal of Rural Studies, 49, 58-68.

Daizy, A.F., Anjum, M., Arman, M.R., Nazia, T., Shah, N. (2021), Long-run impact of globalization, agriculture, industrialization and electricity consumption on the environmental quality of Bangladesh. International Journal of Energy Economics and Policy, 11(6), 438-453.

Dao, M.Q. (2012), Population and economic growth in developing countries. International Journal of Academic Research in Business and Social Sciences, 2(1), 6-17.

Edeme, R.K., Nkalu, N.C., Cidenyi, J., Arazu, W.O. (2020), Infrastructural development, sustainable agricultural output and employment in ECOWAS countries. Sustainable Futures, 2, 100010.

Fanqi, Z., Tinghui, L. (2022), The impact of agricultural ecological capital investment on the development of green circular economy. Agriculture, 12(4), 461.

General Statistics Office. (2019), Economic-Social Situation Report Q4 and 2019. Available from: https://www.gso.gov.vn/du-lieu-va-so-lieu-thong-ke/2019/12/bao-cao-tinh-hinh-kinh-te-xa-hoi-quy-iv-va-nam-2019 [Last accessed on 2023 Jun 01].

Golley, J., Wei, Z. (2015), Population dynamics and economic growth in China. China Economic Review, 35, 15-32.

GSO (General Statistics Office). (2020), Available from: https://www.gso.gov.vn

Ha Nam Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Ha Nam Statistical Office.

Hai Duong Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Hai Duong Statistical Office.

Hai Phong Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Hai Phong Statistical Office.

Hang, J. (2020), The gross output agricultural productivity gap. Economics Letters, 191, 109118.

Hanoi Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Hanoi Statistical Office.

Hung Yen Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Hung Yen Statistical Office.

Inumula, K.M., Singh, S., Solanki, S. (2020), Energy consumption and agricultural economic growth nexus: Evidence from India. International Journal of Energy Economics and Policy, 10(6), 545-552.

Islam, M.Z., Ahmed, Z., Saifullah, M.K., Huda, S.N., Al-Islam, S.M. (2017), CO2 emission, energy consumption and economic development: A case of Bangladesh. The Journal of Asian Finance, Economics and Business, 4(4), 61-66.

Khalid, E.E., Anwar, N., Arintoko, A. (2020), Long-run impact of globalization, agriculture, industrialization and electricity consumption on the environmental quality of Bangladesh. International Journal of Energy Economics and Policy, 10(4), 9-16.

Kwakwa, P.A. (2012), Disaggregated energy consumption and economic growth in Ghana. International Journal of Energy Economics and Policy, 2(1), 34-40.

Le, T.T.H., Nguyen, V.C., Phan, T.H.N. (2022), Foreign direct investment, environmental pollution and economic growth-an insight from non-linear ARDL co-integration approach. Sustainability, 14(13), 8146.

Long, N.T. (2020), Do foreign direct investment, energy consumption and urbanization enhance economic growth in six ASEAN countries? Journal of Asian Finance, Economics and Business, 7(12), 33-42.

Ministry of Education and Training. (2021), Geography Textbook. Vietnam: Vietnamese Educational Publishing House.

Mohsen, A.S., Chua, S.Y. (2015), Effects of trade openness, investment and population on the economic growth: A case study of Syria. Hyperion Economic Journal Year, 2(3), 14-23.

Nam Dinh Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Nam Dinh Statistical Office.

Nguyen, D.K., Nguyen D.B. (2022), Impacts of Climate Change on the Yield of Some Key Crops in the Red River Delta. Industry and Trade Magazine-Scientific Research Results and Technology Application. Available from: https://tapchicongthuong.vn/bai-viet/tac-dong-cua-bien-doi-khi-hau-den-nang-suat-mot-so-nong-san-chu-luc-o-dong-bang-song-hong-86455.htm

Nguyen, H.T.T., Huynh, M.D. (2021), Factors Affecting Agricultural Economic Growth in Can Tho City. Industry and Trade Magazine.

Nguyen, V.C., Thanh, H.P., Nguyen, T.T. (2020), Do electricity consumption and economic growth lead to environmental pollution? Empirical evidence from association of Southeast Asian nations countries. International Journal of Energy Economics and Policy, 10(5), 297-304.

Nguyen, V.C., Vu, D.B., Nguyen, T.H.Y., Pham, C.D., Huynh, T.N. (2021), Economic growth, financial development, transportation capacity, and environmental degradation: empirical evidence from Vietnam. The Journal of Asian Finance, Economics and Business, 8(4), 93-104.

Ninh Binh Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Ninh Binh Statistical Office.

Pei, T.L., Shaari, M.S., Ahmad, T.S.T. (2016), The effects of electricity consumption on agriculture, service and manufacturing sectors in Malaysia. International Journal of Energy Economics and Policy, 6(3), 401-407.

Pham, P.N., Tran, T.Y. (2022), Factors affecting income from public agricultural land use: An empirical study from Vietnam. Journal of Asian Finance, Economics and Business, 9(6), 1-9.
Quang Ninh Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Quang Ninh Statistical Office.
Rehman, N.U., Hysa, E. (2021), The effect of financial development and remittances on economic growth. Cogent Economics and Finance, 9(1), 1-15.
Rinosha, K.F., Mustafa, A.M.M. (2021), Nexus between financial development and economic growth: Evidence from Sri Lanka. Journal of Asian Finance, Economics and Business, 8(3), 165-170.
Salahuddin, M., Alam, K., Ozturk, I., Sohag, K. (2018), The effects of electricity consumption, economic growth, financial development and foreign direct investment on CO2 emissions in Kuwait. Renewable and Sustainable Energy Reviews, 81, 2002-2010.
Siregar, A.P., Widjanarko, N.P.A. (2022), The impact of trade openness on economic growth: Evidence from agricultural countries. Journal of Asian Finance, Economics and Business, 9(3), 23-31.
Soetriono, S., Soejono, D., Hani, E.S., Suwandari, A., Narmadity, B.S. (2020), Challenges and opportunities for agribusiness development: Lesson from Indonesia. Journal of Asian Finance, Economics and Business, 7(9), 791-800.
Solneta, D.J., Ford, R.C., Robinson, R.N., Ritchie, B.W., Olsen, M. (2014), Modeling locational factors for tourism employment. Annals of Tourism Research, 45, 30-45.
Tao, Y.D. (2004), Education and allocative efficiency: Household income growth during rural reforms in China. Journal of Development Economics, 74(1), 137-162.
Thai Binh Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Thai Binh Statistical Office.
Tian, Y., Wang, R., Yin, M., Zhang, H. (2023), Study on the measurement and influencing factors of rural energy carbon emission efficiency in China: Evidence using the provincial panel data. Agriculture, 13(2), 441.
Tran, T.Q., Vu, H.V. (2019), Land fragmentation and household income: First evidence from rural Vietnam. Land Use Policy, 89, 104247.
Vinh Phuc Statistical Office. (2021), Provincial Statistical Yearbook 2010-2020. Vietnam: Vinh Phuc Statistical Office.
Vu, V.H., Ho, H., Le, Q.H. (2019), Impact of farmer education on production efficiency: The case of rice farms in Vietnam. Management Science Letters, 9(11), 1909-1918.
Zhai, R., Loub, Z. (2022), Chinese agricultural output and TFP: 1661-2019. Economics Letters, 213, 110415.
Zhaoxing, Z., Hongda, J., Qian, Y. (2022), The influence of corporate social responsibility on business performance: Evidence from agricultural enterprises in China. Journal of Asian Finance, Economics and Business, 9(3), 83-94.
Zhou, Z., Jia, H., Yang, Q. (2022), The influence of corporate social responsibility on business performance: Evidence from agricultural enterprises in China. Journal of Asian Finance, Economics and Business, 9(3), 83-94.
Zou, F., Li, T. (2022), The impact of agricultural ecological capital investment on the development of green circular economy. Agriculture, 12(4), 461.