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What Driving Gross Domestic Product of Agriculture? Lessons from Indonesia (2014-2021)

Rosyadi Rosyadi[1], Surya Darma[2*], Dio Caisar Darma[3]

[1] Department of Economics and Development Studies, Faculty of Economics and Business, Universitas Tanjungpura, Pontianak 78115, Indonesia
[2] Department of Agroecotechnology, Faculty of Agriculture, Universitas Mulawarman, Samarinda 75117, Indonesia
[3] Department of Management, Sekolah Tinggi Ilmu Ekonomi Samarinda, Samarinda 75242, Indonesia

Corresponding Author Email: surya_darma@faperta.unmul.ac.id

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ABSTRACT

Developing markets such as Indonesia are now concentrating open agriculture, which is actualized in the share of global agro-industry. At the same time, the existence of dependence on agricultural products between one nation and another, is articulated as an opportunity and a competitive advantage. This paper evaluating the factors driving the GDP of agriculture in Indonesia. Data duration is 2014-2021. The construction of the analysis is framed by linear regression. It was found that employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer have a simultaneous impact on GDP of agriculture. Then, employment in agriculture, precipitation, food production, livestock production, and fertilizer have a partial impact on the GDP of Agriculture. Unfortunately, arable land and crop production do not have a partial impact on the GDP of Agriculture. Long-term prospects consider dimensions that are not influential to be developed holistically. Another point is also considering the GDP of agriculture in a more competitive exploration. Weaknesses of this scientific paper are highlighted for academic contributions and practical compilations. In the future, limitations on data extraction can be developed. Furthermore, practical policy elaboration as the primary key in agricultural institutions, strengthening farmer innovation, and protecting agricultural land from the threat of increasingly extreme temperature depletion and massive settlement development.

1. INTRODUCTION

Today, the issue of agricultural sustainability never stops being studied. Expansive urban development continues to cut agricultural land, Beckers et al. [1], Bren d'Amour et al. [2], del Mar López et al. [3], Fazal [4], and Radwan et al. [5] giving rise to a crisis for some jobs that still rely on this sector [6]. In fact, not a single high-income nation left agriculture amid the pressure of the "industrial revolution". When the open market shakes developing nations, they actually respond by exploiting natural resources, without rethinking the urgency of agriculture. At the same time, efforts to maintain agriculture side by side with industrial progress have led to an unequal transition [7-8]. In an instant, secondary and tertiary economic structures, such as for example: construction, transportation, trade, services, finance, processing, and manufacturing for the short term guarantee material benefits, but in essence, agriculture is the locomotive of human civilization when it is born until it grows up. Since centuries, agriculture has been seen as a valuable asset, although it has transformed from traditional to modernization, the life cycle relies heavily on this primary sector [9-11].

Based on the report from World Bank [12], the growth trend of the GDP of agriculture in Indonesia in 2014-2021 was relatively stagnant, where in 2015 it was the highest, reaching 13.49 percent and the lowest in 2019, around 12.71 percent. The average growth rate for 2014-2021 is 13.25 percent. Agricultural growth still dominates among other business fields in the economic structure, but in the past 8 years, employment in this sector has actually decreased. The average worker engaged in agriculture grew by around 32.37 percent. The World Bank [13] claims that the growth in agricultural employment in 2021 will be 28.5 percent. This figure is inversely proportional to 2014 where growth was even higher, namely 35.95 percent. This means that there is a decrease of 7.43 percent from 2014 to 2021.

Jiuhardi et al. [14] portrays the less skilled agricultural workforce in Indonesia. This is in sharp contrast to the creative workforce in India, not to mention the competitiveness of agricultural workers from China and the U.S. The majority of agricultural clusters in Indonesia are still conventional, so the population who work as farmers only rely on manual equipment [15]. Surprisingly, this profession is abandoned by the younger generation because it is believed that it does not generate profits [16]. At its peak, the price of rice imposed by the government through the "cheap food prices" program tends to harm farmers. The striking age between generations of workers has spurred a decline in agricultural entrepreneurship enthusiasm [17-18]. Thus, the welfare of farmers who have lost access to more extensive land management is at stake. According to Ngadi and Nagata [19], the depletion of arable land for food crops and livestock production has also been drastically reduced by government regulations that give businessmen permission to manage forests and switch to oil palm plantations.

Precipitation is defined as a process of melting clouds due to the influence of high air temperatures [20]. Precipitation is the end of a series of stages that cause rain to fall [21]. Bai et al. [22], Joshi et al. [23], Gornall et al. [24], and Mechiche-Alami and Abdi [25] observe the dynamics of climate change on agricultural productivity. Climate change in China is having a negative and significant effect on agricultural productivity. Substantively, climate management combined with solar radiation, rainfall, and soil surface temperature has a significant impact on variations in the productivity of agricultural land in West Africa. From the U.S. (Southern Part), the growth of agricultural production is not determined by climate variability, but by irrigation efficiency. Then, climate change has a positive interaction with global agricultural productivity.

Besides the intensity of precipitation which affects extreme rainfall levels or vice versa, the quantity of poor rain in several agricultural areas, which is concentrated in certain seasons, hampers production conditions. Applying fertilizer at inappropriate doses also has an impact on plant fertility which does not last long [26-28]. There is a wrong mindset by most farmers who want to get big profits and a short harvest period by ignoring crop productivity. This argument is clarified by Peng et al. [29], where the quality of food and crop production decreases, the income of farmers decreases. In the end, the reduced level of consumption due to low welfare, triggers a decrease in the level of market demand or simply reduces the agricultural workforce.

The Global Economy [30] notes that the average precipitation in 2014-2021 in Indonesia is around 2,707 mm per year. The average precipitation level was stagnant for 2014 to 2017. After that, it decreased in 2018: 2,619 mm and increased again from 2019 to 2020 or an increase of 7.17 percent per year. It is connected to the land area. Of the total land area in Indonesia, the average growth rate for agricultural land is 13.88 percent. The largest in 2021: 14.68 percent and the lowest in 2014: 12.97 percent. Even though it had decreased from 2019 to 2020 reaching -1.52 points as a result of the COVID-19 pandemic which required the government to implement a "lockdown" status for residents to isolate independently, including crucial areas such as routine agriculture, logistics and transportation, but that was only temporarily stopped. Please note, agricultural productivity is also relevant to the production of crops, food, and livestock. Less than a decade ago, livestock production was superior to crop and food production. The average index compared to 122.4 points with 101.6 points and 104.7 points. Implicitly, livestock production in 2021 is the highest at 168.1 points, while the lowest was in 2014: 91.1 points. For food production, the highest was in 2020: 114.4 points and the smallest contribution was in 2016: 98.1 points. From other situations, the largest increase in fertilizer use by farmers was in 2021: 236.4 kg per hectare, but the smallest use of agricultural fertilizer was in 2014: 198.4 kg per hectare. At that moment, the use of fertilizers in Indonesia seemed to be ludicrous, with an average of 221.8 kg per hectare.

Universally, referring to the gap in literature in Indonesia's agricultural structure which is getting worse compared to other countries with agricultural mobility, ideally should improve regulation. The reason is, although developed countries do not have large resources, they are transitioning and are able to modify agricultural systems that are more aggressive. Too, agricultural communities in developed countries are adaptive to every change. The reality is that Indonesia, which is popular for its rich resources, faces agricultural polemics that are always unresolved. The key is introducing new agricultural concepts, consistency with designed policies, and not only adapting to natural characteristics, but also non-physical ones such as: economy, tradition, social, consumer tastes, and market share.

Regardless of the heavy burden borne by Indonesia, to concentrate the sophistication of innovative works by setting aside agriculture is not a solution. The dilemma between losing or protecting agriculture is both a challenge and an opportunity for all interested parties. Referring to the premise above, the motive in this paper is to investigate the relationship between employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer to the GDP of agriculture. The motivation and essence that is narrated focuses on Indonesia, which is known as an “agricultural country”. The research corridor recommends an understanding of agriculture that brings together labor, natural, and economic resources from across time, management instructions that conduct agriculture from a conceptual perspective, and initiates principles in agricultural policy schemes. The outline of the paper is organized into 5 sessions: introduction, methodology, results, discussion, and conclusions.

2. MATERIALS AND METHOD

2.1 Sampling

The characteristics of the data are secondary. Material is compiled from annual macro data selected from the releases of the Global Economy [30] and the World Bank [12-13]. After that, the database was filtered into a time span of 8 periods: 2014-2021. The sample was applied to the Indonesian case study. The objectivity of the sample is 56 items ($n = 56$).

2.2 Structure of variables

The composition of the variables consists of two types: the dependent variable and the independent variable. The dependent variable was played by GDP_{Ag} and 7 independent variables were highlighted by EA, Ptn, AL, CP, FP, LP, and Ftr. The independent variable group is in a position to driving the dependent variable [31]. The independent variable is identical to "X", while the dependent variable is often called "Y" [32-33].

Table 1 displays the name, abbreviation, and definition of each variable. Before the data is processed and investigated, especially for "precipitation" which has the most prominent range of values compared to other variables, the indicators are simplified with logarithms.

2.3 Quantitative analysis

The research orientation adapts to exploratory causality [34-36]. The linear-time series regression technique supports empirical testing. This analysis is very popular in business and social experiments [37-38]. After the data is collected, it is operated using SPSS. The series of identification processes is illustrated in Figure 1.

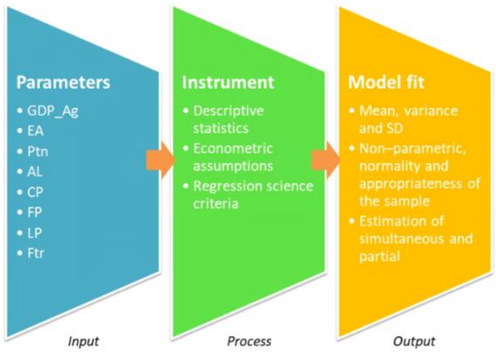

Figure 1. Data verification
Source: Own

The quantitative approach starts with descriptive statistics. The benefits of descriptive statistics are highlighting the potential relationship between variables and providing basic information about the variables in the dataset [39]. At this stage, descriptive statistics distribute: mean score, variance score, and standard deviation score (SD). The formulation on the mean is arranged below:

$$X = \frac{\sum f_n . X_n}{\sum f_n} \tag{1}$$

Description of symbols; X is mean, X_n is data of n-th, and f_n is n-th frequency.

The mathematical terms in the variance and standard deviation are written as follows:

$$S^2 = \frac{\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} \bar{x}_1)^2}{\mathrm{n(n-1)}} \tag{2}$$

$$SD = \sqrt{\frac{\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} \bar{x}_1)^2}{\mathrm{n(n-1)}}} \tag{3}$$

Description of symbols; S^2 is variance, SD is standard deviation, X_i is value of x i-th, $\bar{x}$ is average, and n is sample size.

Before entering the empirical implications, it is corrected through econometric assumptions. There are 3 sections including: non-parametric (Kolmogorov-Smirnov test), normality (Shapiro-Wilk test), and sample eligibility: One-sample test. The formulations in K-S are compiled as follows:

$$E_N = \frac{n_i}{N} \tag{4}$$

Description of symbols; E_N is empirical ordered data points, n_i is number of points less than Y_i, and N is linked data point.

$$D = \max_{1<i<N} \left(F(Y_i) - \frac{i-1}{N}, \frac{i-1}{N} - F(Y_i) \right) \tag{5}$$

Description of symbols; D is maximum value of $F(Y_i) - \frac{i-1}{N}$ or $\frac{i-1}{N} - F(Y_i)$, $F(Y_i)$ is cumulative probability distribution, max is maximum, N is linked data point, and i-1 is the distribution of data minus 1.

Table 1. Indicators and label

Key variable	Code	Specification	Source
Gross Domestic Product of Agriculture	GDP_{Ag}	Share of a GDP of agriculture or value added (net output subtracted from intermediate inputs) of agriculture to accumulated GDP. Proxy into %.	[12]
Employment in Agriculture	EA	Workers who provide services or produce goods for profit or wages in the agricultural sector. Proxy into % of the total workforce.	[13]
Precipitation	logPtn	Long-term average precipitation at depth (over time and space). Proxy in mm per year.	[30]
Arable Land	AL	Land for temporary fallows, pasture for grazing, temporary crops, and land for kitchen or market gardens. Proxy to % of the total land area.	[30]
Crop Production	CP	Regional aggregates and crop income groups, excluding forage crops. Proxy to the index.	[30]
Food Production	FP	Food plants considered to contain nutrients and can be eaten, with the exception of coffee and tea. Proxy to the index.	[30]
Livestock Production	LP	Livestock production includes: leather, wool, raw silk, honey, eggs, milk, meat and milk, including dairy products such as cheese. Proxy to the index.	[30]
Fertilizer	Ftr	Use of fertilizers for plant nutrition per unit of arable land, excluding traditional fertilizers: plant and animal manure. Proxy into kg per hectare of arable land.	[30]

Decision standard:
- H_a is accepted, where D is smaller than $D_{n,\alpha}$ in the K-S ($D < D_{n,\alpha}$), and
- H_o is rejected, where D is equal to or greater than $D_{n,\alpha}$ in the K-S ($D = D_{n,\alpha}$ or $D \geq D_{n,\alpha}$).

And the conclusion procedure:
- if H_a is accepted, the data follows the model distribution, and
- if H_o is rejected, the data does not follow the model distribution.

The systematic steps for S-W are designed as follows:

$$T_3 = \frac{1}{D}\left[\sum_{i=1}^{K} \alpha_i \left(X_{n-i+1} - X_i\right)\right]^2 \tag{6}$$

Description of symbols; D is based on the formula below, α_i is coefficient of S-W, X_{n-i+1} is the (n) number - i + 1 in the data, and X_i is the i-th number in the data.

To get a "D" score, the following is stated:

$$D = \sum_{t=i}^{n} (X_i - \bar{X})^2 \tag{7}$$

Description of symbols; X_i is the (i) number in the selected data, t is time, and $\bar{X}$ is data average.

For the "G" score, it is elaborated into the following formulation:

$$G = b_n + c_n + \ln\left(\frac{T_3 - d_n}{1 - T_3}\right) \tag{8}$$

Description of symbols; G is identical to the Z normally distributed, T_3 is refer to the formula above, b_n, c_n, d_n is conversion on S-W that reflects normality, and ln is natural logarithm.

This assumption is actualized by calculating the S-W value and the degree of probability (ρ). With SPSS, S-W is shown the probability positions. Then, the T_3 score is compared with ρ. The representation is detailed below:

- where; $\rho \geq 5\%$, H_a is accepted, and
- where; $\rho < 5\%$, H_o is rejected.

In principle, one-sample test that implies a certain value as a real comparison or not with the average of a sample. Here, the one-sample test is interpreted by the t-statistic or probability to measure the population with the following simulation:

$$t = \frac{\bar{X} - \mu}{SD/\sqrt{n}} \tag{9}$$

Description of symbols; $\bar{X}$ is sample mean score, μ is test score, SD is standard deviation, and n is sample.

The criteria for projecting t-statistics are tabulated below:

- H_o is rejected, when $\rho_{value} < 5\%$, and
- H_a is accepted, when $\rho_{value} \geq 5\%$.

The third phase is criteria in the science of regression. This pillar indicates simultaneous estimation and partial estimation. These two tests look at individual (respectively) and collective performance on variables. In the F-statistic (Fisher's exact test), the simultaneous relationship is formed as follows:

$$F = \frac{R^2/_{(n-1)}}{(1 - R^2)/_{(n-k)}} \tag{10}$$

Description of symbols; R^2 is determination coefficient, n is total data, and k is independent variables.

Basic understanding to answer the hypothesis in the following settings:

- $F_{statistics}$ and F_{table} is H_o: $\beta = 0$, then H_o is rejected, and
- $F_{statistics}$ and F_{table} is H_a: $\beta \neq 0$, then H_a is accepted.

Especially for partial predictions (Student's test), the universal equation functions are detailed as follows:

$$\sum_{i=1}^{n} \varepsilon_i^2 = \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 x_i)^2 \tag{11}$$

Description of symbols; i is data distribution, n is sample, ε is error term, y is explanatory variable, x is estimator variable, and β is beta.

To start with, the partial relationship is setup as follows:

$$y_x = \alpha_0 + \alpha_1 X \tag{12}$$

Description of symbols; y_x is respons partial correlation on the response variable, α_0 is constant, α_1 alpha, and X is predictor variable.

Referring to the linear equation, we include alternative variables which are modified to correct the individual relations as follows:

$$Y = \alpha_0 + \alpha_1 X\beta_1 + \log \_\alpha_2 X\beta_2 + \alpha_3 X\beta_3 + \alpha_4 X\beta_4 + \alpha_5 X\beta_5 + \alpha_6 X\beta_6 + \alpha_7 X\beta_7 + \varepsilon_t \tag{13}$$

Description of symbols; Y is GDP of Agriculture, α_0 is constant, log is logarithm of regression, $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$ is alpha regression, and $X\beta_1, X\beta_2, X\beta_3, X\beta_4, X\beta_5, X\beta_6, X\beta_7$ is coefficient of Employment in Agriculture, Precipitation, Arable Land, Production of Crop, Food and Livestock, Fertilizer, and ε_t is error term in time-series.

It makes sense to formulate the following two hypothetical scenarios:

- H_o rejected, if Sig. > 5%, and
- H_a accepted, if Sig. < 5%.

With the above assumptions, the following articulated hypothesis interpretations:

- GDP of agriculture is influenced by employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer;
- GDP of agriculture not affected by employment in agriculture, precipitation, arable land, crop production, food production, livestock production, dan fertilizer.

3. RESULTS AND DISCUSSION

3.1 Main findings

Table 2 verifies the descriptive statistical scores on each of the various variables. Precipitation as the most superior variable among the others in obtaining the highest variance, SD, and mean. For these three items, variance: 4,348.21 points, SD: 65.95, and mean score: 2,706.75 points. Another reality based on descriptive statistics, GDP of agriculture actually gets the lowest variance, SD, and mean scores which are illustrated by 0.12 points, 0.34 points, and 13.24 points. Of these eight variables, 3 of them are visualized in percent units: GDP of agriculture, employment in agriculture, and arable land. Then, 3 other variables have index benchmarks: food production, crop production, and livestock production. Only 2 variables whose indicators are articulated with different specifications, i.e. precipitation (mm per year) and fertilizer (kg per hectare of arable land).

Table 2. Trend of descriptive statistics (n = 56)

Variables	Variance	SD	Mean
EA	6.98	2.64	32.38
Ptn	4,348.21	65.95	2,706.75
AL	0.404	0.63	13.88
CP	4.22	2.05	101.61
FP	48.63	6.97	104.7
LP	1,247.58	35.32	122.36
Ftr	137.06	11.71	221.8
GDP_{Ag}	0.12	0.34	13.24

Source: Authors

Table 3 presents the first econometric assumptions in this model, which are bridged by non-parametrics using K-S scores. This test compares parallel data in samples to normal distribution or decides on sample units that come from the study population [40-41].

Table 3. Summary of non-parametric tests

Variables	Sig.	Decision
EA	0.200[1,2]	Retain the null hypothesis
logPtn	0.032[1]	Reject the null hypothesis
AL	0.200[1,2]	Retain the null hypothesis
CP	0.200[1,2]	Retain the null hypothesis
FP	0.017[1]	Reject the null hypothesis
LP	0.039[1]	Reject the null hypothesis
Ftr	0.200[1,2]	Retain the null hypothesis
GDP_{Ag}	0.200[1,2]	Retain the null hypothesis

Source: Authors; Noted: [1]Lilliefors corrected; [2]This is a lower bound of the true significance

In essence, of the 8 observed variables, precipitation ($\rho = 0.032 < 0.05$), food production ($\rho = 0.017 < 0.05$), and livestock production ($\rho = 0.039 < 0.05$) do not follow the model distribution or H_0 is rejected, except for employment in agriculture, arable land, crop production, fertilizer, and GDP of agriculture ($\rho = 0.200 > 0.05$) for which the data follows the distribution of the model or H_0 is accepted.

Table 4. Equality of the probability distribution

Variables	Statistic	Sig.
EA	0.965	0.858
logPtn	0.872	0.156
AL	0.929	0.507
CP	0.947	0.682
FP	0.789	0.022
LP	0.754	0.009
Ftr	0.924	0.466
GDP_{Ag}	0.936	0.572

Source: Authors

The second assumption is the S-W score to test normality. Shapiro-Wilk is a pattern that maps the distribution of data formulated by Shapiro and Wilk [42]. This method is a valid and effective normality test method directed at a small sample. In fact, only food production and livestock production have H_0 rejected, where $\rho = 0.022 < 0.05$ and $\rho = 0.009 < 0.05$. Fantastically, six variables: employment in agriculture ($\rho = 0.858 > 0.05$), precipitation ($\rho = 0.156 > 0.05$), arable land ($\rho = 0.507 > 0.05$), crop production ($\rho = 0.682 > 0 .05$), fertilizer ($\rho = 0.466 > 0.05$), and GDP of agriculture ($\rho = 0.572 > 0.05$) the data distribution is classified as "normal", which means if H_0 is accepted (see Table 4).

Third, the one-sample test, which is allocated with a degree of two-way probability. This assumption is one of the analyses of data containing one sample group and the decision-making process is applied with t-statistics or represented by probability [43]. In contrast to the non-parametric based K-S test, this test belongs to the parametric test, whose assumptions must be fulfilled by the data before ending with partial regression and simultaneous regression.

Table 5. Result of one-sample test

Variables	t-statistics	Sig. (2-tailed)	95% confidence interval	
			Lower	Upper
EA	34.65	0.000	30.16	34.58
logPtn	979.29	0.000	3.42	3.44
AL	61.78	0.000	13.35	14.41
CP	139.98	0.000	99.89	103.33
FP	42.47	0.000	98.87	110.53
LP	9.79	0.000	92.83	151.89
Ftr	53.59	0.000	212.01	231.59
GDP_{Ag}	109.79	0.000	12.96	13.53

Source: Authors

In the context of the level of statistical difference between the population mean and the hypothesized value, Table 5 confirms that the sample probability of each variable is concluded to be significant. At two-way probability, the output is less than 5 percent ($\rho = 0.000 < 0.05$), so H_0 is rejected. Furthermore, in linear regression, Fisher's test is generally applied which compares the F-statistic with the F-table and the probability value with the significance level. The benefit of this test is to determine the accuracy of a method that determines the variance of repeated tests [44-45].

Based on Table 6, the simultaneous correlation (R) reaches 0.985 or close to a score of 1 (perfect) which indicates that the research model is "very strong". The F-table obtained 1.83, then when compared with the acquisition of the F-statistic of 5.264, the results of the F-statistic were above 1.83 (5.264 > 1.83). A set of independent variables is proven to significantly affect the dependent variable, so that H_0 is accepted.

Table 6. Simultaneous effect

Items	Value
R	0.985
Standard error	0.158
Sum of squares	0.790
Mean squares	0.132
F	5.264
Sig.	0.032

Source: Authors

In partial estimation, the Student's test is implemented to reveal a partial relationship between the eight independent variables and the dependent variable [46]. This test is part of a linear regression to test the falsity or correctness of the independent variables independently of the dependent variable (see Table 7).

At the 95 percent confidence level, it is proven that employment in agriculture, precipitation, food production, livestock production, and fertilizer have a partial impact on the GDP of agriculture. The probability of achieving the variable that has a significant effect is below 5 percent, where employment in agriculture: $\rho = 0.029$, precipitation: $\rho = 0.032$, food production: $\rho = 0.003$, livestock production: $\rho = 0.008$, and fertilizer: $\rho = 0.014$. The more these five increase throughout 2014-2021, the more the GDP of agriculture will increase in a positive direction. This is shown by the coefficient scores on employment in agriculture (β = 0.008), precipitation (β = 0.005), food production (β = 0.016), livestock production (β = 0.003), and fertilizer (β = 0.005). The remaining two variables: arable land and crop production, have no partial impact in a negative direction on the GDP of agriculture. This is because the significance is below 0.05 or ρ = 0.578 and ρ = 0.815. Too, the coefficient score is negative. The more these two variables increase, the more it reduces the GDP of agriculture by 0.393 and 0.027. Empirical phenomena as shown by the coefficient α reaching 7.103 with the value of ρ is 0.046 between employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer experiencing changes, increasingly indicating a unidirectional and significant effect.

Table 7. Partial effect

Variables	Coefficients	t	Sig.
Constant	7.103	2.547	0.046
EA	0.008	2.860	0.029
Ptn	0.005	2.635	0.032
AL	-0.393	-0.781	0.578
CP	-0.027	-0.300	0.815
FP	0.016	4.971	0.003
LP	0.003	4.356	0.008
Ftr	0.005	3.302	0.014

Source: Authors

3.2 Justification

The findings of the analysis traced two variables whose hypotheses were rejected, namely arable land and crop production, while five variables: employment in agriculture, precipitation, food production, livestock production, and fertilizer, the hypothesis was actually accepted. R Square (R^2) is intended to see the aggressiveness of the regression line referring to the actual data. On the coefficient score, R Square also pays attention to the percentage of the total variance of the dependent variable which is represented by the independent variable [47-49]. Logically, the reputation of the variables: employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer is very reliable. The strength of these independent variables affects the GDP of agriculture, with a coefficient of 0.969. Only 0.031 other factors outside this topic. Figure 2 displays the structural path equations.

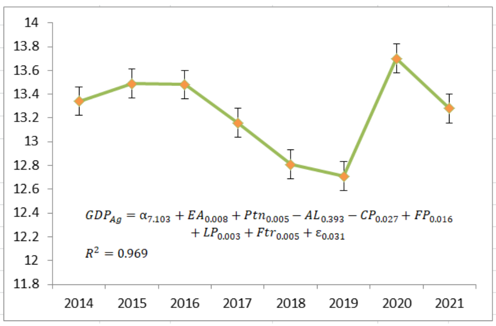

Figure 2. Determination on GDP of agriculture

Source: Own

Publications that investigate the link between the labor force and GDP growth in many countries are discussed. In Pakistan, agricultural growth has largely contributed to an increase in the labor force [50]. In cases in Eastern Europe and Central Europe, agricultural GDP relatively reduces unemployment [51]. The position of agriculture in the U.S, the Netherlands, Indonesia and China from time to time is quite vulnerable due to the narrow employment trap and the increasingly narrow share of agriculture [52]. Interactively, Roser [53] shows that the workforce in poor countries mostly works in agriculture.

Damania et al. [54], Dumrul and Kilicarslan [55], and Sangkhaphan and Shu [56] detected precipitation anomalies which are inputs in agricultural production, influenced by global climate change, so they are very sensitive to agricultural GDP in Turkey and Indonesia. On a spatial scale, macro-econometric effects encourage precipitation which has a broad impact on vital parts of the economy, especially agricultural products as the main way to fight poverty and multidimensional polemics. As a result, precipitation activity in developed countries does not have a significant impact on the agricultural economy, but in add, precipitation is actually felt in developing countries which have difficulty cultivating agriculture. Surprisingly, from Thailand, the increase in precipitation has actually become a blessing for poor and dry provinces that rely on the agricultural sector. In rich provinces, precipitation has a negative effect on the agricultural sector, because areas with upper middle incomes tend to concentration on the industrial and service sectors.

The agenda for managing fertile land in the perspective of sustainable agricultural development continues to be called for. In eradicating extreme poverty, various nations in the world have realized that converting arable land in protected areas to intensifying agricultural inputs is positively correlated to welfare, alleviating poverty, increasing agricultural land use, and increasing crop yields [57]. The consequences of externally converting agricultural land have the potential to reduce agricultural productivity. In line with the study of Harini et al. [58] who concluded that conversion of agricultural land stimulated a decrease in soil fertility, so that there was a negative determination of agricultural GDP. Lanz et al. [59] emphasize that erratic productivity as a risk from agricultural land conversion and global economic growth strains are key exacerbations of per capita income and population growth in low-income nations. Over the past few decades, the transition to agricultural land, which has become increasingly scarce, has also drastically changed economic mechanisms, including the depletion of food production [60].

In the literature of agricultural productivity, declines in crop, food, and livestock production signal a bad and complex level of agricultural emergency. The amount of food production sourced from agricultural land has a dominant effect on Indonesia's GDP [61]. Infrastructure projects in the Indian economy, such as the development of agricultural inputs, have a significant relationship to agricultural GDP [62]. Changes in multi-regional environmental elements tend to fluctuate the added value of food production, which is not evenly distributed and creates inequality in the agricultural sector [63]. Industrialization of major crop production has positively affected GDP growth in Zimbabwe [64]. The convergence of economies in developing markets is growing much faster than developed countries of world food supply-demand frequency. The implications are calculated by shifting away from food patterns determined by agricultural resources [65]. Yao et al. [66] believes that investment in agriculture has a direct positive effect on food production in nations that are members of the Belt and Road Initiative (BRI). The trend of agricultural intensification continues to surge as greater expansion of crop production in major nations drives food demand [67]. Globally, the livestock sector is very dynamic. Many livestock production systems driven by growing urbanization, human population, and incomes have responded to the rapid increases in livestock production in developing nations, but have contrasted with the stagnant developed nations. Improvements in livestock-based livelihoods have commercial implications in terms of socio-economic disparities [68-69].

From 1978 to 2015, Rehman et al. [70] predicted that fertilizer consumption is positively correlated in controlling agricultural GDP in Pakistan. Then, Chandio et al. [71] evaluated the relationship between fertilizer consumption, which has a significant effect on rice production in Pakistan. McArthur and McCord [72] calibrated cross-country tests using empirical instruments. As a result, the government's strategy through the provision of subsidized fertilizers shows a strong role for the growth of agricultural inputs. At the regional level in China, panel data involving 30 provinces has proven to be very dependent on chemical fertilizers, which have a linear ratio to agricultural yields to increase per capita GDP in agriculture [73]. Fertilizer policy support is the main key in crop production and increasing agricultural welfare in China, Russia, Indonesia and India [74]. FAO [75] simulates prevention, tightening, and limiting agricultural production due to political escalation in Russia which threatens international and domestic concerns by implementing scenarios of setting fertilizer tariffs that are increasingly expensive.

4. CONCLUSIONS

The target of the paper addressing the factors that influence the GDP of agriculture from Indonesia. The seven factors are proportional to: employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer. Uniquely, employment in agriculture, precipitation, arable land, crop production, food production, livestock production, and fertilizer simultaneously have a significant positive impact on the GDP of agriculture. Other results show that employment in agriculture, precipitation, food production, livestock production, and fertilizer have a partially positive and significant impact on the GDP of agriculture. Besides that, arable land and crop production actually do not have a significant impact on the GDP of agriculture in a negative direction.

Overall, this work exposes when employment in agriculture, precipitation, food production, livestock production, and fertilizer are empowered, so that it reacts to an increase in GDP reaching 0.8%, 0.5%, 1.6%, 0.3%, and 0.5%. Other constructs also share a negative response, where the more access to arable land and crop production is channeled, it automatically does not cover or actually reduces GDP by 39.3% and 2.7%.

The volume of economic growth from the agricultural sector in developing markets, such as Indonesia, is often discussed. However, not much has been highlighted from a technical perspective related to nature, such as: precipitation, arable land, or fertilizer. For that reason, to broaden shallow insights, this paper reinforces the novelty of the research. In addition, the analysis findings inspired scientists about anomalies in precipitation and fertilizer that afaciffect soil fertility, thereby stimulating agricultural productivity. Long-term prospects consider other dimensions that do not affect the GDP of agriculture to be developed holistically. Talking about agricultural economic growth whose foundation is agricultural productivity, this is closely related to arable land. Rationally, the executive needs to collaborate with stakeholders in the agricultural sector to prioritize crop, food and livestock productivity, to prevent food security polemics in the future.

Interestingly, looking at the reaction from the partial no effect on the GDP of agriculture, it implies that in the short term, the contribution is weak. Obstacles in arable land that are less productive and weak crop production, thus disrupting the GDP of agriculture. Even so, stakeholder intervention in reforming the agro-industrial system, protecting the prices of livestock, plant and food commodities, as well as subsidizing fertilizers according to the farmer's scale and production capacity. What is currently the focus of attention is that the average precipitation throughout the year in Indonesia is categorized as "quite high", but the GDP of agriculture is actually less consistent. In reality, Indonesia only has 2 seasons: dry and rainy, but the complex problem is that the dry season lasts for around 7 months or April-October. On the one hand, the level of rainfall in Indonesia generally lasts 5 months: November-March. To anticipate the shortage of irrigation stocks, the government needs to build a comprehensive irrigation system. Farmers in Indonesia need to do introspection. In this case, concrete practices by decision makers in empowering farmers that facilitating knowledge, carry out competent monitoring, break the poverty chain, develop technology networks and centralize agricultural marketing, and revitalize agro-industry in an integrated manner. This method is not instantaneous, but it is a contemporary option that can trigger change and understanding of farmer behavior.

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