Evaluation of the implementation of sustainable farming insurance in Indonesia

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Abstract. The factors that influence a program's success determine targets as part of planning, resources, and communication. In contrast, previous research results suggest factors that influence farmers' interest in agricultural insurance are income, risk results, program support, and regional characteristics. This research aims to evaluate the implementation of Farming Insurance (AUTP/Asuransi Usaha Tani Padi) by identifying the conformity and gap between the implementation of farming insurance from 2015 to 2017. Furthermore, based on regression using the panel fixed effect model, the result shows that the variable number of civil servants instructors and risk on the previous year negatively affects the realization of farming insurance distribution on the eight equation models. This shows that civil servants instructors' performance is not yet optimal in supporting the implementation of farming insurance. The decline in civil servant's instructor performance is due to the difficulty in measuring the accountability of the civil servant instructor's performance. Therefore, accountability of the instructor's performance in supporting the program's implementation can be more measurable. As a recommendation, the government needs to start reviewing the Public-Private Partnership system to provide farming insurance to be implemented more broadly.

1. Introduction
The role of the agricultural sector in the Indonesian economy is quite significant. The agricultural sector's contribution to the Gross Domestic Product (GDP) of the First Quarter of 2018 reached 13.26 percent (the second highest contributor after the manufacturing industry sector, contributing to Indonesia's GDP by 20.27 percent). Furthermore, half the GDP of the manufacturing industry sector is based on the agricultural sector. Besides, the agricultural sector is a sector that absorbs quite a lot of labor. Based on the Indonesia Statistical Bureau data for the first quarter of 2018, the agricultural sector is the sector that absorbs the most enormous labor (30.46% of total labor). While the second-largest labor absorbing sector is the trade sector (18.53 % of total labor).

However, the agricultural sector's contribution to national GDP does not necessarily bring prosperity to its people. Based on Indonesia Statistical Bereau data, the number of poor people in rural areas in March 2018 was 13.20 percent, while the number of low urban areas was only 7.02 percent. This data shows that many Indonesian farmers are categorized as low because most Indonesian farmers live in rural areas.

The inability of agricultural businesses to increase their welfare is caused by the high risks and uncertainties threatening their business in this sector. [14] said unexpected events that have harmful effects (such as floods, hurricanes, plant disease infections, or earthquakes) impact agricultural sectors' huge losses. On the other hand, [6] identify eight types of risk inherent with the agricultural sector's supply chain, namely: weather risk, natural disasters, environmental risk, market risk, logistical risk, operational risk, policy risk, and political risk. The high business risk lowers the likelihood of farmers and entrepreneurs to work in the agricultural sector. Therefore, many studies
emphasize a downward trend in the agricultural sector in developing countries and third world countries [14]. In Indonesia, a declining trend in the agricultural sector also occurs. Based on the agricultural census results in 2013, there was a decrease in the number of Agricultural Business Households by 16.32 percent if compared to the agricultural census in 2003.

One attempt to overcome the risk and uncertainty of business is through agricultural insurance (as an instrument to perform the risk management). Agricultural insurance is an attempt to reduce the likelihood of unfavorable results or reduce the effect of the risk [14]. However, according to [11], the benefits of agricultural insurance for farmers include providing protection (economically) from the effects of natural forces and accidents and as a form of collateral that allows farmers to obtain capital through loans at a lower cost.

The indicator to show farmers' purchasing power is the Farmer Exchange Rate (Nilai Tukar Petani/NTP). Indonesia Statistical Bureau defines farmer exchange rate as a comparison of farmers' price index to the price index paid by farmers. The farmer exchange rate also shows the term of trade of agricultural products produced by farmers with goods and services consumed and production costs. The value of farmer exchange rate > 100 means that the farmer experiences a surplus because the selling price of commodities produced has more significant increases than the increase in the prices of goods consumed by farmers, which indicates that the increase in farmer's income is more significant than their expenditure. On the other hand, if the value of the farmer exchange rate < 100, the selling price of agricultural commodities produced is relatively smaller than the increase in prices of goods consumed, indicating that farmers' income falls, smaller than their expenditure. The implementation of the farming insurance program can maintain the stability of the farmer exchange rate or even increase it because it can reduce the increase in production costs when farmers experience crop failure.

The farmer exchange rate can be separated between farmer exchange rate for food crops (NTTPP), horticulture (NTPH), smallholder plantations (NTPR), livestock (NTPT), fisheries (NTNP), capture fisheries (NTN), and aquaculture (NTP). For rice farmers, the farmer exchange rate for food crops is used as an indicator of farmers' purchasing power because rice is included in food crops classification.

This research is conducted to evaluate the implementation of the farming insurance program running for three periods. Evaluation is conducted by analyzing the suitability of the implementation with the theory and results of previous research regarding the factors that influence the program's success and the factors that influence farmers' interest in agricultural insurance. By analyzing the suitability and gap between the implementation and the theory, policy recommendation can be identified because it is needed to improve the implementation of the farming insurance program in the future.

1.1. Analysis factors that influence farmer decision making to follow agricultural insurance

[5] stated the definition of insurance by several experts. According to Prof. Mehr and Cammack, insurance is a social tool to reduce risk combinations of group risk so that individual loss can be collectively predicted. On the other hand, according to Molengraaf, the insurance loss is an agreement on which one party, the insurer, binds itself to the other. The insured replace losses that the insured perceives because of the occurrence of some of the decisions that have been determined, uncertain and accidental, with which the insured promise to pay the premium.

The fully intervened system model is a model chosen by the Indonesian government in the early stages of farming insurance implementation. According to [4], the fully intervened system model is an insurance model characterized by huge government costs (high fiscal costs), the provision of monopolistic agricultural insurance, and a high level of market penetration. For farming insurance, two characteristics of the fully intervened system model have been implemented: the substantial premium subsidy support approximately 80% of the total premium, and the provision of monopoly insurance, namely PT. Jasindo is the only insurance company that provides this insurance.

Many studies have been conducted to identify the factors influencing a farmer's decision making to participate in agricultural insurance. [13] evaluated the demand for agricultural insurance in the continent of America and Europe. Research conducted using logit regression models based on secondary data. The results show that land area, premium subsidy, farmer education level and yield risk have a positive and significant effect on demand for agricultural insurance, while insurance premiums negatively affect demand for agricultural insurance. Curak et al. [13] stated that education
would increase risk avoidance and encourage non-life insurance. The results also show that agricultural insurance development must be accompanied by economic and institutional policies such as agricultural development policies and managing agricultural products’ risk.

[11] This examines the factors that influence farmers in accepting agricultural insurance in Iran are socio-economic factors, namely the level of education, the age of farmers, land area, contact with agricultural experts, and farmer's income. Nahvi also highlighted that farmers’ contacts with agriculture experts positively influence farmers to participate in agricultural insurance to increase farmer's acceptance of agricultural insurance. The government needs to implement a knowledge-sharing program by increasing agricultural experts' communication and insurance representatives.

[3] suggested that social factors, such as farmer's age and education level, positively affected the farmer's decision to participate in agricultural insurance. Social factors influence the level of risk aversion from farmers. Still in [4] study, land area according to [4] also positively affected agricultural insurance. Whereas Smiths and Baque in [4] found that premium rates were important factors for farmers in choosing agricultural insurance. Dan Shaik et al. [4] found that farmers who felt a greater risk of yield were more interested in buying insurance.

[14] found that the age, education level, and income of farmers influence farmers' decision to participate in agricultural insurance. The age of the farmer indicates the ability or capacity to manage his farming business. Besides, it also affects the ability of farmers to adopt innovation and change. Education level is a factor that can influence the decision-making capacity of farmers by increasing knowledge and awareness of the benefits and disadvantages of a technology or a government program. Low farmer income causes them difficulty in adopting an expensive technology. [14] found that farmers' loans and the extent of ownership of paddy fields influenced farmers' decisions to follow agricultural insurance. Farmers tend to have a greater desire to participate in agricultural insurance when they have more expansive fields and have more loans. Summary of results from previous studies, as seen in Table 1 below:

Table 1. Factors that influence farmers join agriculture insurance.

| Factors                        | Malini (2011) | Nahvi et.al (2014) | Singh (2017) | Branstrand (2014) | Sihem (2017) |
|-------------------------------|---------------|------------------|--------------|-------------------|--------------|
| Level of premium              | √             |                  | √            |                   | √            |
| Requirements                  |               |                  |              |                   |              |
| Socialization                 | √             |                  |              |                   |              |
| Farmers as the primary business |              |                  |              |                   |              |
| Level of education            | √             | √                | √            |                   |              |
| Age                           |               |                  |              |                   |              |
| Income                        | √             |                  |              |                   |              |
| Loan                          |               |                  |              |                   |              |
| Land areas                    |               |                  |              |                   |              |
| Indemnity                     | √             |                  |              |                   |              |
| Level of subsidy              |               |                  |              | √                 |              |
| Risk                          |               |                  |              |                   | √            |

2. Method
This research aimed to see the factors that affect the realization of the farm areas protected by farming insurance, as the dependent variable. A summary of the variables that are used in this study is shown in Table 2.

Table 2. Dependent and Independent Variables.

| Variable | Symbol | Explanation                                      | Hypothesis | Source |
|----------|--------|--------------------------------------------------|------------|--------|
| Dependent| Y      | Farm areas that are protected by farming insurance | H₀        | H₁     |
| Independent| TARGET | Government plan as shown by farm areas as the target of farming insurance in each | No | Positive | [1] |

Source: IOP Publishing, doi:10.1088/1755-1315/716/1/012092
| Variable | Description | Influence | Reference |
|----------|-------------|-----------|-----------|
| NTPP | The farmer exchange rate on food crops in each province as a proxy of average level of income | No Influence | [14] |
| PENYULUH PNS | Civil servants instructors in each province, proxy of human resource and communication in farming insurance implementation | Positive | [1] |
| PENYULUH THL | Part-time instructors in each province, a proxy of human resource and communication in farming insurance implementation | Positive |
| PENYULUH SWADAYA | Self-supporting counselors in each province, the proxy of human resource and communication in farming insurance implementation | Positive |
| RISIKO | Risk result variable as shown by farm areas that impacted by risk (flood, droughts and pest and plant disease attacks or plants pest organisms (Organisme Pengganggu Tumbuhan/OPT) | Positive | [3] |
| SERAPAN | A variable of the Directorate General of Food Crops in each province in the form of Special Allocation Funds and Assistance Tasks, which are proxies of program assistance | Positive | [9] |
| SUMBPDRB tan | Variation of the regional characteristic variable which is dominated by the agricultural sector, indicated by the contribution of the agricultural sector to the total GRDP in each province in the current year and the previous year (t-1) | Positive | [10] |
| SUMBPDRB ind (t-1) | Variation of the regional characteristic variable which is dominated by the industrial sector, indicated by the contribution of the industrial sector to the total GRDP in each province in the current year and the previous year (t-1) | Negative |
| PDRBtan and PDRBtan (t-1) | Variation of regional characteristic variables seen from the value of the agricultural sector GRDP is a province in the current year and the previous year (t-1) | Positive |
| PDRBind and PDRBind (t-1) | Variation of regional characteristic variables seen from the value of GRDP in the industrial sector in the current year and the previous year (t-1) | Negative |
| PDRBtan/ PDRBind and PDRBtan (t-1) /PDRBind (t-1) | Variation of regional characteristic variables seen from the dominance of the agricultural sector compared to the industrial sector in a province in the current year and the previous year | Positive |

To evaluate the implementation of the farming insurance, the first step is analyzing the regression to see the link between the farming insurance realization variable and the variable found. Considering the characteristic of the owned data is a combination of time series data and cross-section, the linear regression model used is linear data panel regression. Based on the hypotheses that have been built, the realization of the land area that is protected by farming insurance is a function of the target, the farmer exchange rate for food crops, the number of civil servants extension workers, part-time...
extension workers, self-supporting counselors, risk results, budget absorption variable of the Directorate General of Food Crops, and regional characteristics. With variations in regional characteristics as control variables, the regression equation model is written as follows:

$$\text{LNREALISASI}_t = a + b_1 \text{LNTARGET}_t + b_2 \text{LNNTPP}_t + b_3 \text{LN PENYULUH PNS}_t + b_4 \text{LN SERAPAN}_t + b_5 \text{SUMBPDRBind}_t + e_t$$

$$\text{LNREALISASI}_t = a + b_1 \text{LNTARGET}_t + b_2 \text{LNNTPP}_t + b_3 \text{LN PENYULUH PNS}_t + b_4 \text{LN SERAPAN}_t + b_5 \text{SUMBPDRBtan}_t + e_t$$

$$\text{LNREALISASI}_t = a + b_1 \text{LNTARGET}_t + b_2 \text{LNNTPP}_t + b_3 \text{LN PENYULUH PNS}_t + b_4 \text{LN SERAPAN}_t + b_5 \text{SUMBPDRBind}_t + e_t$$

This study used unbalanced panel data considering the number of provinces that apply farming insurance from 2015 to 2017 differ each year, namely 16 (sixteen) provinces in 2015, 23 (twenty-three) provinces in 2016, and 26 (twenty-six) Provinces in 2017. Thus the number of panel data in this study is 65 data.

### 3. Results and discussion

The data used in this study are secondary data sourced from the Ministry of Agriculture and Indonesia Statistical Bureau from 2015 until 2017 [2]. Considering the variation in unit data used, data can be normally distributed. The data used is, first, transformed into a narrative logarithm. The following are descriptive statistics from the data that will be used in the further analysis:

| Variable         | 2015          | 2016          | 2017          |
|------------------|---------------|---------------|---------------|
|                  | Obs | Mean | Std. Dev | Obs | Mean | Std. Dev | Obs | Mean | Std. Dev |
| LNREALISASI      | 16  | 8.91 | 1.32     | 24  | 8.69 | 2.24     | 24  | 9.30 | 2.07     |
| LNTARGET         | 16  | 10.73| 0.86     | 24  | 10.10| 1.13     | 24  | 10.13| 1.13     |
| LNRSIKO          | 24  | 9.90 | 1.24     | 24  | 10.03| 1.23     | 24  | 9.78 | 1.23     |
| %SUMBPDRBind     | 24  | 20.96| 8.95     | 24  | 20.94| 9.39     | 24  | 20.16| 9.01     |
| %SUMBPDRBtan     | 24  | 16.53| 10.34    | 24  | 16.52| 10.21    | 24  | 16.50| 10.13    |
| LNSERAPAN        | 24  | 25.06| 0.71     | 24  | 25.55| 0.97     | 24  | 25.76| 0.83     |
3.1. Results of the selection of the panel data regression model.
Based on the correlation test between independent variables, it is known that there is a strong relationship between planning variables with self-supporting counselor variables with a correlation coefficient of 0.822783. In connection with these findings, then the two variables are then separated, so that the model which is built in this equation develops into 12 models, to give an overview of the effect of planning on farming insurance realization and also the influence of self-supporting instructors on the realization of farming insurance.

Based on the output of the Chow Test panel data regression with Eviews on the three model equations as attached (Appendix 3), are known that p-value of the Chi-Square Cross-section on the overall model that is built is worth 0.0000. Considering that the p-value is smaller than 0.05, H0 is rejected, which means that the FE model is better at estimating the relationship between variables in the three models in this study compared to the FE model.

Furthermore, based on the Hausman test results which are done by using the reviews software, the following results are obtained:

| Equation   | p-value Crosssection Random | Equation   | p-value Crosssection Random |
|------------|-----------------------------|------------|-----------------------------|
| Equation 1 | 0.0001                      | Equation 7 | 0.0041                      |
| Equation 2 | 0.0013                      | Equation 8 | 0.0238                      |
| Equation 3 | 0.0023                      | Equation 9 | 0.0050                      |
| Equation 4 | 0.0193                      | Equation 10| 0.0222                      |
| Equation 5 | 0.0006                      | Equation 11| 0.0025                      |
| Equation 6 | 0.0129                      | Equation 12| 0.0194                      |

Based on the Chow test results and the Hausman test above, then to conduct a regression analysis on the entire model built by using panel fixed effect model data regression, which is from now on referred to as Fixed Effect 1 until Fixed Effect 12.

**Classical Assumption Test Results**
After knowing the best model to explain the relationship between variables in this study is the fixed-effect model, the next step is to do the classic assumption test to detect the presence or absence of deviations from the classical linear regression model's basic assumptions. The classic assumption test results are as follows:

1. **Multicollinearity Test**
   Based on the test results, the model that has been proven to be free from multicollinearity symptoms is the Fixed Effect 1 model, Fixed Effect 2, Fixed Effect 3, Fixed Effect 4, Fixed Effect 5 and Fixed Effect 6 (by removing the LNPDRBtan variable), Fixed Effect 9, Fixed Effect 10, Fixed Effect 11, and Fixed Effect 12.

2. **Heteroscedasticity test**
   Based on the results of the Glesjer test with Eviews version 10 on 2 (two) tested models free from multicollinearity symptoms, it is known that in fixed-effect four there are symptoms of heteroscedasticity, which based on the results of regressing the independent variable with absolute regression, the probability value t statistic one variable is 0.059 where the value is close to 0.05.

3.2. **Regression Analysis Results**
After the model is free from classical assumptions deviations, the model can be used in the subsequent analysis.
Table 5. Fixed Effect Model Regression.

| Variable | Fixed Effect 1 | Fixed Effect 2 | Fixed Effect 3 | Fixed Effect 4 | Fixed Effect 5 | Fixed Effect 6 | Fixed Effect 7 | Fixed Effect 8 | Fixed Effect 9 | Fixed Effect 10 | Fixed Effect 11 | Fixed Effect 12 | Fixed Effect 13 |
|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| C        | 5,899.27       | 2.868.095      | 47.27          | 9,140.738      | 4,982.965      | 2,595.955      | 7,372.983      | 2,930.84       | 122400         | 8**            |                 |                 |                 |
| LNTARGET | 0.949          | 0.847          | 1.277.118780   | -              | -              | -              | -              | -              |                 |                 |                 |                 |                 |
| LNTPP    | 4.272.478      | 2.219.449      | 3.276.721      | 1.966.051      | 0.870.070      | 0.233.116      | 3.839.98815    | -              |                 |                 |                 |                 |                 |
| LNPENYUHPSNS | 10655.10523     | 95164.8335     | 75209.84936    | 84465.869424   | 114501         |                 |                 |                 |                 |                 |                 |                 |                 |
| LNPENYUHTHL | 30774.32969    | 24039.1851     | 25899.2101     | 2405.23696     | 255783         |                 |                 |                 |                 |                 |                 |                 |                 |
| LNPENYULUH | 1.385.203      | 1.857.334      | 1.205.149      | 1.913.637      | 2.027.49       |                 |                 |                 |                 |                 |                 |                 |                 |
| SWADAYA  | 1.385.203      | 1.857.334      | 1.205.149      | 1.913.637      | 2.027.49       |                 |                 |                 |                 |                 |                 |                 |                 |
| LNRSIKO(t-1) | 0.923.602**    | 0.965.212**    | 0.867.311**    | 0.726.136*     | 0.905.997**    | 0.836.831*     | 0.88962.831*   | 1.06849.831*   |                 |                 |                 |                 |                 |
| LNLSERAPAN | 0.859.303**    | 10078.870*     | 0.732.997*     | 0.837.136*     | 0.943.831*     | 0.673.831*     | 0.93650.831*   | 0.31375.831*   |                 |                 |                 |                 |                 |
| %SUMBPDRBtan | 0.022.006     | 155.430        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| %SUMBPDRBind | 10716.449***  | 0.882          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| %SUMBPDRBtan(t-1) | 0.091         | 0.901          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| %SUMBPDRBind(t-1) | 0.214         | 0.701          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| LNPDRBind | 3,508.911     |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| PDRBtan/PDRBind | 1,364.069     |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| PDRBtan(t-1)/PDRBind(t-1) | 0.723        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| LNRISIKO*DUMMY RAWAN | 178413        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| R-squared | 0.934.0908     | 0.931.792      | 0.919.771      | 0.919.319      | 0.914.291      | 0.916.555      | 0.915.231      | 0.91565.231    | 0.93054.231    |                 |                 |                 |
| F-statistik | 14.68          | 14.13          | 11.85          | 12.61          | 11.81          | 12.16          | 11.95          | 12.0183.12.0183 | 12.9510.12.9510 |                 |                 |                 |                 |

Notes: ***significance at level 1%, **significance at level 5%, and *significance at level 10%.

Based on the regression analysis test results on the 8 (eight) models that are constructed as seen above, the determination coefficient value ($R^2$) of the model ranges from 0.91 to 0.93. This shows a strong determination, where the variation of the dependent variable, namely the realization of the area protected by farming insurance can be explained by variations in the independent variables in each equation by between 91 percent and 93 percent [7].

The $F$ value statistic (for testing the impact of independent variables on dependent simultaneously) ranges from 11.81 to 14.68. A probability value of 0.00 indicating that the model built can be used for analysis because it is evidence that the independent variable in each equation can simultaneously influence the realization variable of the land area protected by farming insurance [10].
4. Conclusion
According to the results, it can be concluded that in general the implementation of farming insurance is not consistent with the theory and the research results from before on the factors that affect the outcome of a program and the factors that affect the interest of a farmer towards crop insurance. This robust inconsistency occurs in the number of civil servants extensions and the land area affected by the risks of flood, drought, and pest attack risks a year before. Based on the theory and the results of the research from before, the two variables gives a significantly positive effect towards the realization of crop insurance, but in this research the number of civil servants extensions and the risk from the year before gives a negative effect towards the realization of land area that is protected by farming insurance.

The negative influence between the realization of farming insurance and the number of civil servants extensions shows that agricultural extension civil servants' performance has yet to support the implementation of farming insurance. The lack of performance quality from them has been concluded from several research done by the World Bank. Meanwhile the adverse effects from the risks last year towards the realization of farming insurance were caused by the government's intervention who implemented quota restrictions from 40-60, which was 40 percent from the target is meant for areas that are highly prone to risks and 60 percent for areas that has a low to medium level prone to risks. This is not gainful for the farmers because it can close opportunities for farmers who need protection from crop failure to follow farming insurance.

Therefore, the research results in the effects of Ditjen TP's budget adsorption variable. The characteristics of an area that dominates the industrial sector also give an inconsistent effect on the theory, even if it was not quite robust. The inconsistent result with the theory to the budget adsorption from the Directorate general of food corps is caused by an implemented system called “bundling” to distribute farming insurance programs. Then, the industrial sector's domination in certain areas was caused by the high level of financial literacy of the people living there, comparable to the ones living in agricultural sectors.

Last, the targets per province variable are not significant in affecting the realization of land covered by farming insurance. This is not consistent with the theory, which indicates the existence of a failure in the planning in determining the targets by the Ministry of Agriculture. The farmer exchange rate for the food crops variable also does not have a significant effect on the whole model that was built. The value of the regression coefficient that is not consistent between positive or negative causes the relationship between the variable and the realization of the land area protected by the farming insurance cannot be made to the conclusion.

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