Analysis of factor that influences decision making for the implementation of the integration system of oil palm and cattle in Serdang Bedagai Regency plantations

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Abstract. Integration of oil palm and cattle is the union of oil palm plantation and beef cattle cultivation businesses to overcome the problem of waste (zero waste), but this system is not implemented on plantations due to various factors. This study aims to assess the plantation decision-making process and to analyse the factors that influence the decision making of oil palm plantations for the implementation of the integration system of oil palm and cattle in Serdang Bedagai Regency plantation. The research used a descriptive method, and the data were analysed using binary logistic regression analysis. The result of this research showed that oil palm plantations in Serdang Bedagai Regency carrying out integration were 41 plantations, while those who did not carry out integration were 25 plantations. Wald test results showed, technical factors and risk factors those are cattle damage plants, Ganoderma, and horn beetles (Oryces rhinoceros) (P<0.05) had a significantly affected the decisions of the plantation. It is concluded that Factors of age, experience, authority, technical, economic, and institutional factors had a positive influence on the decisions of the plantation. Meanwhile, the risk factors had a negative influence on the decisions of the plantation.

1. Introduction
Integration of livestock and plant businesses are a form of good practice known as the crop-livestock system. The practice of crop-livestock systems further guarantees the realization of a sustainable agriculture system [1]. The history of integration on Indonesian plantations began with the Dutch East Indies Government in 1806. The palm and cattle integration program reintroduced since the revitalization of agriculture, livestock, and forestry launched by the President of the Republic of Indonesia in 2005 and entering 2007. Some local governments make it a flagship program to achieve the goal of self-sufficiency in meat, one of which is the Serdang Bedagai District government, which in 2007 planned the establishment of an integrated palm and cattle area. Then in 2012, the Minister of BUMN required all PT. Perkebunan Nusantara to raise cattle by issuing a letter of the Ministry of BUMN Number S - 50 / D1.MBU / 2012 dated 22 February 2012 concerning the pattern of integration of cattle farms in oil palm plantations and Minister of BUMN Letter Number S - 240 / MBU / 2012 dated 09 May 2012 concerning the assignment of the implementation of the integration program of palm and cattle. The program has been running, but only about 1% of plantation companies have implemented it. Until 2014 the oil palm and cattle integration program had a legal basis, namely the Minister of Agriculture Regulation Number 105 of 2014.
Oil palm plantations produce by-products throughout the year and can be used as animal feed ingredients, therefore the palm-cattle integration program is technically and economically feasible [2], but the system of integration does not work on all plantations because the plantation considers that cattle are pests for oil palm [3] so that plantations prohibit cattle from entering the plantation location by placing prohibited signs on the plantation site. This is the background for carrying out a study of the plantation decision-making process and the factors that influence decision making for the implementation of the integration system.

2. Research methods

2.1 Research approach
The research method used was the census method with a total of 66 respondents (24 plantation companies and 42 smallholder plantations) and analysed by type of case study research, conducted through interviews and questionnaires.

2.2 Types and data sources
The type of data used in this study is primary data and secondary data. The primary data in this study was all the data taken from state plantations, private plantations, and smallholder plantations in Serdang Bedagai Regency with interview methods and questionnaires. Secondary data was obtained through literature studies by reviewing reports, written material, and research results from related institutions such as universities, Central Bureau of Statistics, and the Department of Agriculture of Serdang Bedagai Regency.

2.3 Data and information collection techniques
Data collected in this study are primary data and secondary data. Primary data is obtained using:
   a. Interview method, which is conducting structured interviews using questionnaires that have been made in advance according to the problem and research objectives
   b. The Observation Method, which is to make direct observations in the field and determine the factors that influence the system of integration of oil palm and cattle.

2.4 Operationalization of research variables
Variables in research are attributes of a group of objects studied and have variants between one and the other in the group [4]. The measurement scale for this research instrument used is the Likert scale [5], Ratio, and Nominal.

2.4.1 Independent variables (X). Independent variable is variables that influence or are the cause of changes or the emergence of dependent variables [4]. In this case, the independent variables are:
   a. Age Factor (X1) (measured in years)
   b. Experience Factor (X2) (measured in units of years)
   c. Authority factor (X3) (measured in ordinal intervals)
   d. Technical factors (X4) (measured in ordinal intervals and ratio scales)
   e. Risk factors (X5) (measured in ordinal intervals)
   f. Economic factor (X6) (measured in ordinal intervals)
   g. Institutional factors (X7) (measured in ordinal intervals)

2.4.2 Dependent variable (Y). The dependent variable is a variable that is influenced or becomes a result due to the existence of free variables [4]. In this study, the dependent variable is the Plantation Decision Regarding the Implementation of the Oil Palm and Cattle Integration System Program (Y).

2.5 Binary logistic regression
Binary Logistic Regression is used to predict the magnitude of the dependent variable/output
variable, which is a binary/bound variable by using an interval variable with a large scale known [5]. The binary logistic regression model [5] used to test the hypothesis as follows:

\[ \ln \left( \frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 \]  

(1)

**Information:**

- \( P_i \) = Probability for plantations to implement the integration of oil palm and cattle (\( Y = 1 \))
- \( 1 - P_i \) = Probability for plantations not to implement the integration of oil palm and cattle (\( Y = 0 \))
- \( Y \) = Plantation Decision
- \( X_1 \) = Age Factor
- \( X_2 \) = Experience Factor
- \( X_3 \) = Authority factor
- \( X_4 \) = Technical factors
- \( X_5 \) = Risk factor
- \( X_6 \) = Economic factors
- \( X_7 \) = Institutional factors
- \( \beta \) = logistic model constants

2.6 Wald test

Parameter estimation uses a Wald test, which is to see independent variables that have a significant influence on the dependent variable in the logit model [5].

3. Results and discussion

3.1 Factors affecting the decision of oil palm plantations in the implementation of the integration of palm and cattle

The independent variables in the study are the factors of age, experience, authority, technical, economic, and institutional factors. The dependent variable that will be seen from two possibilities, they are the plantation carrying out integration/yes (\( Y = 1 \)), or plantation does not implement integration/any (\( Y = 0 \)).

| Observed | Predicted | Percentage Correct |
|----------|-----------|-------------------|
|          | NO | YES |                |
| Step 1  | Y  | 14  | 11 | 56.0 |
|          | YES | 7   | 34 | 89.9 |

Based on Table 1, it can be seen that the estimation results can classify plantations that do not carry out the integration of oil palm and cattle with an accuracy percentage of 56%. This means that 25 plantations that did not carry out integration, 14 of the total plantations that did not carry out the integration of oil palm and cattle were classified in the decision not to carry out integration while the 11 plantations which should not carry out integration were declared to have implemented palm oil and cattle integration by the model. Then the estimation results can classify plantations that carry out the integration of oil palm and cattle with an accuracy percentage of 89.9%. That is, the plantations that carry out integration are 41 plantations, 34 of the total plantations that carry out the integration of oil palm and cattle are classified in the decision to carry out integration while the 7 plantations that are supposed to carry out integration are declared not implementing palm oil and cattle integration by the
model. Table 1 shows the overall percentage value of 72.7%, which means the accuracy of this research model is 72.7%, so that the variables can be explained by the model.

3.2 Decision-making process

| Decision Making Process | Total |
|-------------------------|-------|
| Oil palm plantation company |       |
| Introduction to needs | Benefits |
| **Additional source of income** | 14 |
| Alternative Determination | Consideration in implementing integration |
| **Cattle interfere with oil palm plants** | 17 |
| Choice alternative |       |
| **Prohibiting cattle societies enter the plantation** | 13 |
| **And prohibits farmers from taking grass.** |       |
| Decision Making | How to get a decision |
| **Decision based on organizational structure** | 20 |
| Most Affecting Source of Decisions |       |
| **Director/ Head of center** | 23 |
| Farmers of smallholder palm oil plantation |       |
| Introduction to needs | Benefits |
| **Additional source of income** | 42 |
| Alternative Determination | Consideration in implementing integration |
| **Operating costs** | 26 |
| Choice alternative |       |
| **Utilizing feed sources from plantations** | 13 |
| Decision Making | How to get a decision |
| **Planned** | 38 |
| Most Affecting Source of Decisions |       |
| **Family** | 28 |

Decision making consists of several stages; those are the problem identification stage, the introduction of needs (benefits), information seeking, the stages of determining alternatives, decision making, implementing decisions, monitoring and evaluating the implementation of decisions [6].

Table 2 shows the decision-making process of plantation companies in the implementation of the integration of oil palm and cattle and data on the process of decision-making of smallholder plantations in the implementation of the integration of oil palm and cattle.

3.3 Wald test

The test in this study uses a confidence level of 95% or at a real level (α) of 5%. The Wald test results in this study can be seen in Table 3.
Table 3. Wald test

| Variable  | B     | Odds Ratio |
|-----------|-------|------------|
|           |       | exp (B)    | Sig |
| Constant  | 8.622 | 5.551      | 0.90 |
| Age       | 0.012 | 0.988      | 0.75 |
| Experience| 0.023 | 0.978      | 0.56 |
| Authority | 0.146 | 0.864      | 0.78 |
| Technical | 3.153 | 2.310      | 0.04 |
| Risk      | -1.963| 4.140      | 0.01 |
| Economic  | 0.390 | 0.677      | 0.45 |
| Institutional | 1.248 | 0.781      | 0.15 |

3.3.1 Effect of age factor (X1) on implementation decisions. In Table 3, it can be seen that the age factor (X1) does not significantly influence the plantation decisions. In addition, there is a B value of 0.012 and an Odds Ratio value of 0.988. This means that age has a positive influence on plantation decisions, and when the age increases by one year, the opportunity to carry out the integration of oil palm and cattle will increase by 0.988 times. Age does not have a real influence on the implementation of the integration of oil palm and cattle because the state plantation companies make decisions based on authority, while in smallholder plantations, the decision is based on the needs and abilities of farmers to carry out the integration of oil palm and cattle.

3.3.2 Effect of experience factors (X2) on implementation decisions. In Table 3, it can be seen that the experience factor (X2) does not significantly influence the plantation decision. In addition, there is a B value of 0.023 and an Odds Ratio of 0.978. This means that experience has a positive influence on plantation decisions, and when experience increases by one year, the opportunity to carry out the integration of oil palm and cattle will increase by 0.978 times. According to [7], one of the basis for decision making is experience-based decision making because the experience can be used as a guide in solving problems.

3.3.3 Effect of authority factor (X3) on implementation decisions. In Table 3, it can be seen that the authority factor (X3) does not significantly influence the plantation decisions. In addition, there is a B value of 0.146 and an Odds Ratio of 0.864. This means that the authority has a positive influence on plantation decisions, and the higher the authority of respondents in the organizational structure, the opportunity to implement the integration of oil palm and cattle will increase by 0.864 times. Every person who becomes a company leader has the duty and authority to make decisions in order to carry out activities in order to achieve effective and efficient company goals, decisions based on authority will lead to dictatorial practices. Decisions based on authority sometimes often go through problems that should be resolved but become less clear [7].

3.3.4 Effect of technical factors (X4) on implementation decisions. In Table 3, the significance value of 0.04 is smaller than the real level of 5%, which indicates that technical factors (X4) have a significant effect on plantation decisions. In addition, there is a B value of 3.153 and an Odds Ratio of 2.310. This means that technical factors have a positive influence on plantation decisions, and it causes the opportunity to implement the integration of oil palm and cattle will increase by 2.310 times. In technical factors, there are sub-variables, namely human resources, beef cattle, manure, weed cleanser, and waste utilization. Plantations must recruit human resources in the field farms or special training on
technical maintenance of cattle for officers in the field so that it is expected that livestock development can be optimal [8].

3.3.5 Effect of risk factors (X5) on implementation decisions. In Table 3 the significance value of 0.01 is smaller than the real level of 5%, which indicates that risk factors (X5) have a significant effect on plantation decisions. In addition, there is a B value of -1.963 and an Odds Ratio of 4.140. This means that risk factors have a negative influence on plantation decisions, and this problem causes the opportunity to implement the integration of oil palm and cattle will decrease by 4.140 times. In risk factors, there are sub-variables, namely cattle damage crops, the issue of cattle is the spread of Ganoderma and the issue of cattle feces was a medium for growing horn beetle’s larva.

The phenomenon of cattle damage oil palm plants has a negative influence on plantation decisions, and when these problems continue, the opportunity to implement the integration of oil palm and cattle will decrease further. Technically cattle are pests for plantations, cattle damage immature plants and also produce crops [3]. But the problem of cattle eating palm leaves can be dealt with by grazing cattle in oil palm plantations that have been harvesting for more than five years. So cattle cannot reach it [1].

Plantation companies do not carry out the integration of oil palm and cattle and prohibit cattle from entering the plantation location because the issue of cattle is the spread of Ganoderma. Technically, cattle transmit Ganoderma, damaging inserts, and causing soil compaction [3]. But according to [1] spread of Ganoderma not by cattle, but by soil spores and wind [1]. The attack of Ganoderma is positively correlated with the generation of oil palm plants, and attacks occur in second or more generation plants. Attack of the Ganoderma fungus through contact of roots to roots in the soil, contact of healthy tree roots with sources of infection in the soil such as solid root pieces and stems containing pathogenic colonies [9]. In addition to Ganoderma, horn beetles (oryces rhinoceros) problem if it is not resolved scientifically, the opportunity to carry out the integration of oil palm and cattle will decrease further. Plantation companies who were respondents to the study said that the plantations did not carry out the integration of oil palm and cattle, prohibited cattle from entering the plantation area and did not use cattle feces as fertilizer for oil palm plants because cattle feces was a medium for growing hornet beetles (oryces rhinoceros) larvae. But according to observations that have been carried out in Mapanget village, Talawan sub-district, North Minahasa Regency, showed that weeds and piles of dried leaf midribs were scattered between oil palm plantations and the remnants of oil palm trees can be used as breeding grounds for horn beetle pests (oryces rhinoceros) [10].

3.3.6 Effect of economic factors (X6) on implementation decisions. In Table 3, it can be seen that the economic factors (X6) have no significant effect on plantation decisions. In addition, there is a B value of economic factors of 0.39 and an Odds Ratio of 0.677. This means that economic factors have a positive influence on plantation decisions, and it causes the opportunity to implement palm, and cattle integration will increase by 0.677 times. The problems that exist in the integration of oil palm - cattle are plantation difficulties in cattle marketing, a realization of selling prices is below-market prices, and realization of program implementation costs is above the basic price so that operational activities are losing money [11].

3.3.7 Effect of institutional factors (X7) on implementation decisions. In Table 3, it can be seen that the institutional factors (X7) have no significant effect on plantation decisions. In addition, there is a B value of 1.248 and an Odds Ratio of 0.781. This means that institutional factors have a positive influence on plantation decisions, and the higher the influence is given in the form of policies or laws, research results, easy access to capital, the opportunity to carry out the integration of palm and cattle will increase by 0.781 times. In institutional factors, there are sub-variables, namely government, financial institutions, research institutions, and farmer groups.

According to [12] The cattle palm integration system can be developed by involving all parties, namely the government through related offices, oil palm plantation companies, both core and plasma, cooperatives, and banking.
4. Conclusion
Determination of decisions on state and private plantation companies is obtained based on the organizational structure of directors / central leaders; meanwhile, the decisions of smallholders had been planned with the family. Factors of age, experience, authority, technical, economic, and institutional factors have a positive influence on the decisions of the plantation. While the risk factors have a negative influence on the decisions of the plantation. Factors that have a significant effect on the decisions of the plantation to implement the integration of oil palm and cattle are technical factors and risk factors (cattle damage plants, Ganoderma, and horn beetles).

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