

Development of a Harvest Purchasing Cost Forecasting System Using the Random Forest Regression Method: A Case Study at PT Sage Maslahat Indonesia

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ABSTRACT

PT Sage Maslahat Indonesia faces challenges in determining the budget for purchasing harvest yields in the pre-harvest stage due to uncertainty in yield estimation, which often leads to budget deviations. This study aims to design and develop a forecasting system for the cost of purchasing harvest yields using the *Random Forest Regression* (RFR) method. The system is developed as a web-based application using Laravel and FastAPI, and processes historical data including land area, rainfall, temperature, farmer purchase price, estimated planting age, and corn varieties. The model is trained and optimized using GridSearchCV to obtain the best parameter combination. The results show that the Random Forest Regression model with default parameters provides the best performance, achieving an R^2 value of 0.8618 on test data, with a Mean Absolute Error (MAE) of 217.93 Kg, Root Mean Squared Error (RMSE) of 354.12 Kg, and Mean Absolute Percentage Error (MAPE) of 29.69%. Feature importance analysis indicates that the Log_Land_Area feature has the most dominant contribution in predicting harvest yields, followed by plant age, rainfall, temperature, and the interaction between rainfall and land area, while variety variables have relatively low contribution. In the system testing phase, Blackbox Testing shows a functional success rate of 100%, and User Acceptance Test (UAT) achieves an acceptance rate of 90,6%, which falls into the very feasible category. Therefore, the developed system demonstrates good generalization capability and is suitable as a decision-support tool for planning harvest purchasing costs more accurately and efficiently.

Keywords: *Harvest Purchasing, Random Forest Regression, Forecasting System.*