ABSTRACT

CV XYZ is a company engaged in the distribution of imported soybeans to various regions in Indonesia, including branches located in Pringsewu, Tangerang, East Bogor, and Tasikmalaya. In its operations, the company relies heavily on accurate inventory management to ensure optimal product availability across all branches. However, fluctuating demand often leads to challenges in managing stock levels. Inaccurate forecasting can result in either overstocking or stockouts, which in turn leads to high storage costs or missed sales opportunities.

Previously, the company used conventional forecasting methods such as manual calculations and basic statistical models. While models like ARIMA and Exponential Smoothing are widely used in forecasting, they have limitations in handling non-linear demand patterns and multi-variable (multi-feature) inputs. To address these issues, this study employs the Artificial Neural Network (ANN) method, which is known for its ability to learn complex relationships between variables and for its flexibility in modeling data patterns.

The choice of ANN in this research is not only based on its strength in recognizing non-linear patterns but also on its ability to leverage large-scale historical data, making it suitable for daily demand forecasting as needed by CV XYZ. The training algorithm used is backpropagation, which has proven effective in iteratively adjusting network weights to minimize prediction errors with high accuracy. Backpropagation is also commonly used in supervised learning, particularly for regression problems like demand prediction.

The problem-solving process began with the collection of historical data from 2023, which included five key variables: selling price, promotion, product quality, seasonality, and market trend (Market_Trend1). To assess the influence of each variable on demand, Pearson correlation analysis was conducted.

The analysis showed that selling price had the strongest correlation with demand (0.999), followed by promotion (0.754) and seasonality (0.615), indicating a strong to moderate relationship. Meanwhile, product quality and market trend had lower correlation values (0.188 and -0.004 respectively). Despite their lower influence, these two variables were retained in the model, as they are still considered important in providing a more comprehensive view of market behavior—particularly for capturing external conditions that may not directly influence demand but could affect long-term trends.

In other words, all five variables were included in the modeling process, as each contributes unique information. No significant multicollinearity was found between features, indicating that their inclusion would not disrupt the model's training process.

Therefore, incorporating all variables is expected to help the model better capture the overall demand pattern.

The model evaluation results show a significant improvement in accuracy compared to previous methods. The Mean Absolute Percentage Error (MAPE) dropped from 36.42% to 3.49%. Additionally, the model demonstrated strong predictive performance, with an accuracy of 92%, precision of 1.00, recall of 0.46, and AUC-ROC of 1.00. These results confirm that the designed ANN model can effectively learn and predict demand patterns and has strong potential for use in inventory decision-making.

In conclusion, the backpropagation-based ANN method successfully addresses the challenges of forecasting complex, non-linear demand, delivering significantly better results than traditional methods. The main challenge lies in selecting the appropriate features to avoid overfitting and ensuring consistent model performance through regular evaluation. The uniqueness of this report lies in the application of ANN in a non-production demand context, combined with market-related features, making it a practical and applicable example of machine learning implementation in the distribution of imported food commodities.

***Keywords**: Soybean demand, demand forecasting, Correlation Test, Artificial Neural Network, MAPE, prediction accuracy*