

A System Dynamics Model for Resilient and Sustainable Corn Procurement System Design in the Feed Industry

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Abstract: The poultry feed industry in Belu Regency faces the challenge of seasonal corn availability, which has the potential to disrupt production continuity. This research aims to design an optimal corn procurement system thru a dynamic system modelling approach. The methodology includes stakeholder data collection, the creation of Causal Loop Diagrams and Stock and Flow Diagrams using Vensim PLE, as well as model validation thru MAPE testing, face validation, and sensitivity analysis. The verified model was then simulated in three procurement scenarios: involving farmers and distributors, the implementation of the Government Purchase Price (HPP) with BUMDES/Cooperative institutions, and mass procurement each harvest season. The simulation results show that the HPP Scenario yields the lowest total cost of Rp25.74 billion, stabilizes prices and supply, and minimizes the risk of overstock and raw material damage. In contrast, the bulk procurement scenario carries a high risk of excessive storage costs, while the basic model results in more expensive fluctuating costs. In conclusion, the intervention of government benchmark pricing policies and the strengthening of local storage institutions are the most effective strategies to balance industrial supply and demand. This scenario is recommended as a strategic blueprint to ensure production sustainability and operational cost efficiency.

Keywords: Corn procurement; Poultry feed industry; Seasonal supply; Simulation model; System dynamics

Introduction

The agricultural sector plays a crucial role in Indonesia's economic structure in terms of achieving national food security (Gina et al., 2023). The development of the poultry feed industry is one of the ways to support national food security by providing quality feed products that can guarantee the availability of animal products such as meat and eggs (Vanany et al., 2021; Wahyono et al., 2018). In the agricultural sector, corn availability is one of the key factors supporting the sustainability of the poultry feed industry (Rasyid et al., 2020). Corn is one of the main components in feed formulation, serving as a source of energy (Direktorat Pakan, 2024; Loy et al., 2018). In its formulation structure, corn requires 60% of the total ration formulation. Consequently, the sustainable accessibility of corn as a raw material at a consistent price is a critical

requirement for the industry's sustainability (Ray, 2021). The management of the supply chain for agricultural commodities, such as corn, possesses intricate characteristics impacted by the product's perishable nature, the growing season, and significant price volatility (Sibuea et al., 2023). Sustainability issues, including as climate anomalies, environmental degradation, and price variations that jeopardize long-term raw material stability, exacerbate these supply chain vulnerabilities in significant corn-producing regions like West Nusa Tenggara (NTB) (Ridwan et al., 2025). This supply instability can result in inefficiencies within the procurement system, thus impacting industry profitability and price stability for farmers.

Efforts to accelerate the down streaming of agricultural products are being promoted throughout the region, including in border areas such as Belu Regency (Bantacut, 2016). A strategic step taken by the

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central government in this region is the development of a poultry feed industry, which is currently in the operational running test. The abundant availability of corn and the high demand for animal feed serve as the basis for the development of this industry, with the aim of achieving regional economic independence and meeting the demand for animal feed for the neighboring country, Timor Leste.

Nonetheless, regional characteristics will pose the primary difficulty for the poultry feed sector, given that corn cultivation and production patterns in this area are seasonal. This seasonal phenomenon is profoundly shaped by land suitability restrictions; cultivation on marginal or inappropriate land types markedly reduces productivity and agricultural efficacy, therefore limiting the steady and optimal availability of maize harvests (Maskumambang et al., 2021). This will create a substantial disparity between supply and demand. The industry is experiencing an increasing demand for feed, with an average domestic requirement of 166 tons per month in the province and poultry feed exports to Timor Leste totaling 611 tons in 2024. In contrast, local corn production exhibits a pronounced seasonal supply pattern, with the primary planting season happening from October to March, while the industry's storage capacity is restricted to 130 tons which has extremely limited capacity to meet production demand. This gap forces the industry to face the possibility of raw material shortages during lean period and significant price volatility.

Since the industry is still in its early stages, it's important to have a robust procurement system plan before it's fully operating. Poor raw material procurement strategies can have serious consequences, like running out of raw materials or higher inventory costs, which can mess with a company's cash flow (Widiaswanti et al., 2024). So, it's necessary a way to simulate how systems behave over time and see how long-term policies affect them. The System Dynamics method is thought to be particularly effective in figuring out this complexity since it can model feedback loops and time delays in supply chain systems (Dudoladov et al., 1976). Previous studies have demonstrated the effectiveness of dynamic systems in solving commodity supply chain problems. Asriani et al. (2025) used this approach to analyze national corn production in relation to food security, emphasizing the importance of interventions in productivity and land areas. In the context of the feed industry (Hakim et al., 2025) modelled the feed supply chain for egg-laying hens to maintain stock and price stability, as well as to optimize the procurement of seasonal raw materials to minimize losses due to storage (Suryani et al., 2021; Widiaswanti et al., 2024).

Although many previous studies have discussed the corn supply chain, research that specifically designs a model for corn procurement policies in the poultry feed industry in areas with seasonal patterns and infrastructure limitations, such as in Belu Regency, is still limited. This study aims to fill this gap by developing a dynamic system simulation model for corn procurement in the poultry feed industry in Belu Regency. Since this industry is still in the running test phase, this research serves as a strategic blueprint for management and government as policymakers to anticipate various risks in the future. Results from this research are expected to not only support the sustainability of the industry but also accelerate downstream in border areas and provide policy recommendations that balance the profits of the industry and the welfare of partner farmers.

Method

This research was conducted at a poultry feed industry that was recently built in Belu Regency, East Nusa Tenggara Province. This location was chosen with the aim to support the acceleration of downstream agricultural products and the economy in border areas, through the design of a corn procurement system, which is the main raw material in the poultry feed industry, so that it can support the sustainability of poultry feed industry development in this area. This research was conducted over a period of six months, from July 2025 to December 2025.

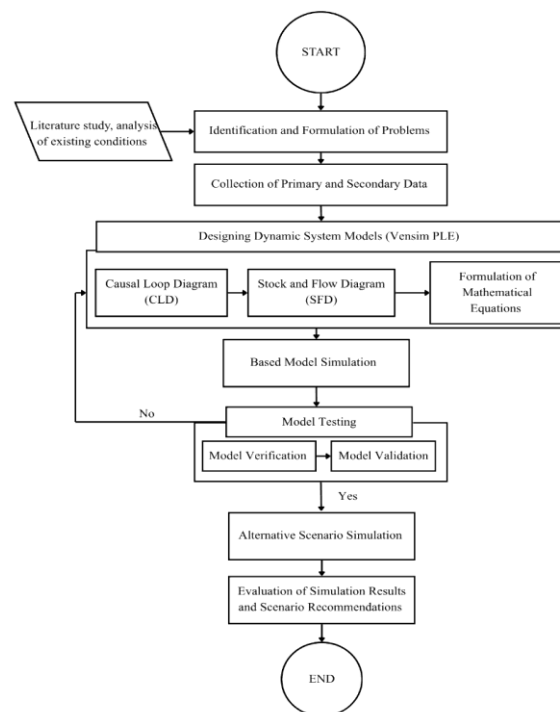


Figure 1. Research flow chart

In this study, the primary and secondary data were used. Considering that the poultry feed industry in Belu Regency is still in the operational running test, data collection was focused on developing the logic of the model structure and input parameters that could represent real conditions. Primary data was collected through field observations to gain an overview of conditions in the field and interviews with several stakeholders using purposive sampling in the corn procurement system as follows: 15 farmer groups, where each group consists of 10 to 15 farmers (Raimanuk, West Tasifeto, Raihat, East Tasifeto, and Lamakenen subdistricts) verified variables such as land area, productivity, and sales preferences, as well as other variables affecting local corn production at the farmer

level. Four local distributors participated in this study to map the pricing mechanism, availability of local corn, and the corn supply chain to observe the dynamics and determining factors of corn availability at the distributor level. Representative of the Trade and Industry Office (1 person): As an industry player who has been involved in preparing the industry from its development to the current trial phase and as a representative of the Agriculture and Food Security Office (1 person): Related to historical data on corn production in the region and other support programs to ensure the availability of local corn in Belu Regency. Secondary Data Includes historical data from official reports and several literature studies related to corn procurement systems in the poultry feed industry.

Table 1. Type and Source of Data

Variable	Data Type	Data Source
Local corn production	Primary and Secondary data	Results of the interview with the farmer and Report on Food Crop Production by Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu
Availability of Corn at the Distributor	Primary data	Results of the interview with the corn distributor
Distributor Procurement Volume	Primary data	Results of the interview with the corn distributor
Farmers Consumption	Primary data	Results of the interview with the farmer
Land Conversion Rate	Secondary data	Report on Food Crop Production from the Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu and (Asriani et al., 2025)
Initial Land Area	Secondary data	Report on Food Crop Production from Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu
Farmers Working Capital	Primary data	Results of the interview with the farmer
Farmers' Corn Price	Primary data	Results of the interview with the farmer
Number of Partner Farmers	Secondary data	Report on Food Crop Production from Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu
Land Productivity	Secondary data	Report on Food Crop Production from Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu
Farmers Expected Price	Primary data	Results of the interview with the farmer
Warehouse Capacity	Secondary data	Data from Dinas Perdagangan dan Perindustrian Kabupaten Belu
Market Demand	Secondary data	Report from the Atambua Customs Office and Data from Dinas Perdagangan dan Perindustrian Kabupaten Belu
Initial Corn Moisture Content	Secondary data	(Mukkun et al., 2018; Timm et al., 2023)
Duration Corn Storage	Secondary data	(Mukkun et al., 2018; Timm et al., 2023)
Production Capacity	Secondary data	Data from Dinas Perdagangan dan Perindustrian Kabupaten Belu

The dynamic system modeling process in this study was conducted in several stages as follows: Problem Articulation and System Boundaries: The data collection results then identified the general conditions and characteristics of the region, including key variables that play a role in the corn procurement system. Further, these identification results were described in terms of system boundaries and stakeholder mapping for the design of a corn procurement system in the poultry feed industry; Model Conceptualization: The key variables that have been determined are then mapped out in a

Causal Loop Diagram. Sterman (1976) stated that Causal Loop Diagrams are a key tool in dynamic systems for mapping the feedback structure within a system; Model Formulation (Stock and Flow Diagram): Translating CLD into Stock and Flow using Vensim PLE simulation software. This stage aims to map the physical and technical structure of the system precisely through mathematical formulation of each variable (Dudoladov et al., 1976). Numerical data obtained from the data collection stage will be used as input to calibrate model parameters divided into several elements, namely

Stock/Level, Rate, and Auxiliary (Godin et al., 2012); Model verification is performed to ensure that the computer model created is consistent with mathematical logic and syntax (Taylor, 1983). This verification stage is carried out computationally using features available in the Vensim PLE software, which consists of two steps, as follows: Check Model: This step is carried out to ensure that all mathematical equations created and their cause-and-effect relationships in the Stock and Flow Diagram formulation show the correct relationship in terms of structure or are free from programming errors; and Check Units: Units that have been applied to each variable are then tested to ensure the dimensional consistency of all the variables used. The model built is declared to pass the verification test if the left and right sides of each equation have equivalent measurement units; Model Validation: Validating dynamic systems is not to prove absolute truth, but to generate a level of confidence that the model created is suitable for use in analyzing policy (Dudoladov et al., 1976; Piedrahita et al., 2025). To build a sufficient level of confidence, this study applies a dual validation approach: Structure Validation: This validation is carried out to ensure that, structurally, the equations and relationships between variables are consistent with the logic of the actual system (Dudoladov et al., 1976). This validation stage is carried out through Face Validation through a series of interviews and discussions with stakeholders involved in this system, which are representatives from the Belu Regency Trade and Industry Department and representatives from the Belu Regency Agriculture and Food Security Department. Face validation serves as a method for assessing the reasonableness of a model or simulation in cases where more advanced techniques, like statistical or sensitivity analysis, cannot be applied (Öztürk, 2023). These two respondents will then become users as stakeholders and policy makers in supporting the availability of local corn and policy makers related to industry operations. Several important things became the main focus in this validation, such as the suitability of variables, the causal relationship between variables, the model structure, and several assumptions and parameters used in building the model; and Behavioral Validation: This validation method is used to measure the accuracy of the simulation results of the model in describing the behavior of the actual system (Suryani et al., 2021). In this study, the Mean Absolute Percentage Error (MAPE) calculation is used to compare the simulation results with the actual results. The MAPE calculation uses the following equation:

$$MAPE = \frac{1}{n} \sum_{t=1}^n \left| \frac{A_t - F_t}{A_t} \right| \times 100\% \quad (1)$$

Note: A_t = Actual data in period t ; F_t = Simulation data in period t ; n = amount of data in the observation period

Simulation and Scenarios Creation: The model is simulated to predict raw material availability and total procurement cost over a period of 3 years. The simulation will be conducted based on several procurement scenarios as follows: Base Model Scenario: This scenario is a basic model built from data collection and an overview of field conditions in line with the characteristics and concepts of the model to be implemented by the industry. In this model, corn procurement in the industry involves distributors as substitutes for corn suppliers when the availability of corn from farmers is insufficient to meet industry demand. This will affect the purchase price of corn, where distributors have a higher selling price of corn than the selling price of corn at the farmer level; Scenario I Corn Price Intervention: In this scenario, the government acts as a corn price stabilizer, whereby the Merah Putih Cooperative or BUMDES serves as a container for all corn produced by farmers in each village so that corn prices do not fluctuate and it is continuously available. The corn price set in this scenario is IDR 5.500/kg, a value based on HPP (government purchase price); and Scenario II: This scenario describes a situation where the industry wants to drive down the purchase price of corn by procuring corn only during the harvest season, thereby eliminating the involvement of distributors or other parties besides farmer partners and the industry.

The results of simulations from several scenarios will then be compared based on procurement costs, which will then become the basis for the industry in developing efficient procurement strategies.

Result and Discussion

This study began with the collection of primary data to identify the main problems faced by each actor in the corn supply chain in this region. Table 1 presents the results of the pain point analysis of each actor involved in the corn supply chain in Belu Regency. The analysis of each pain point aims to identify the variables that play a role in the corn procurement system for the poultry feed industry that will operate in Belu Regency.

Table 2. Stakeholders Pain Point Analysis

Stakeholders	Pain Point	Impact Analysis
Farmer	Limitations of Working Capital	Corn cultivation requires a high amount of working capital, reaching Rp.5.000.000/ha, not including handling costs at harvest time. This is not offset by the fluctuating price of corn, which drops significantly during the harvest season, resulting in low margins for farmers.
	Seasonal Corn Production	The majority of farmers rely on seasonal factors, so corn planting is only carried out during the second planting season (MT I), which is from October to March. Meanwhile, farmers who rely on the conversion of rice fields planted during the first planting season (MT II: April-September) to corn fields during the second planting season.
	Low corn price	The selling price of corn at the farmer level is very low during the harvest season, causing farmers to earn small margins, which prevents them from expanding their corn cultivation areas. The price of corn reaches Rp.3.500/kg.
	Limited cultivated land	Limited working capital prevents farmers from expanding their cultivated land, thereby affecting local corn production growth.
	Limited market access	Due to limited access to markets, farmers rely on collectors, which tends to lead to exploitation of corn prices.
	Pest and Disease Problems in Plants	Pest and disease infestations are also not properly controlled due to farmers limited working capital to purchase the necessary pesticides or fertilizers.
	Low productivity	The average productivity of cultivated land reaches 3 tons/ha, which can be increased if supported by adequate facilities and materials.
Distributors	Price Fluctuations	The purchase price of corn follows seasonal patterns, which means during the lean season, the price of corn reaches Rp.10.000/kg at the distributor level.
	Inconsistent Corn Supply from Local Farmer	The availability of local corn is seasonal, so during the lean season, corn is imported from outside the region.
	Varying quality of corn	The quality of corn from farmers greatly varies, so during storage it is often attacked by warehouse pests because the moisture content does not meet storage standards.
Dinas Perdagangan dan Perindustrian Kabupaten Belu	Fluctuations in corn purchase prices	The implementation of corn price standards has not been realized, so that unstable corn prices greatly affect the operating costs of industries that follow seasonal corn prices.
	Seasonal availability of local corn	The seasonal availability of local corn indicates stockouts during certain periods if the industry relies solely on farmers as its main corn suppliers, since farmers do not have large storage stocks to anticipate corn demand during lean periods.
	Limited warehouse capacity	Warehouses with a capacity of 130 tons to store corn are limited, therefore the industry is unable to procure large quantities during the harvest season.
Dinas Pertanian dan Ketahanan Pangan Kabupaten Belu	Decrease in production land area	The area of cultivated land decreased from 16,531 hectares (2022) to 10,312 hectares (2023) due to El Niño, which occurred in the beginning of 2023. Another reason was commodity competition, which led to a shift in cultivated land.
	Price regulations are not implemented	HPPP (Rp5.500/kg) is not applied in markets in which farmers are still at risk of market price fluctuations.

System Boundary Analysis and Key Variable Identification

According to Stermann (1976), system boundaries are the determination of which variables are included and excluded from the model to be constructed. Determining these system boundaries can help in modeling the system to maintain focus on the analysis objectives (Frehner et al., 2020). The corn procurement system in the poultry feed industry consists of three

elements, which are the dynamics of the local corn supply available in Belu Regency, raw material storage management that focuses on warehouse capacity and poultry feed demand patterns from both the domestic market and the export market to Timor Leste, and the calculation of costs incurred based on dynamic changes in the corn procurement system. This system is divided

into three sub-models, namely the procurement sub-model, the storage sub-model, and the cost sub-model. Figure 2 explains the boundaries of the corn procurement system in relation to input-output variables, both controllable and uncontrollable.

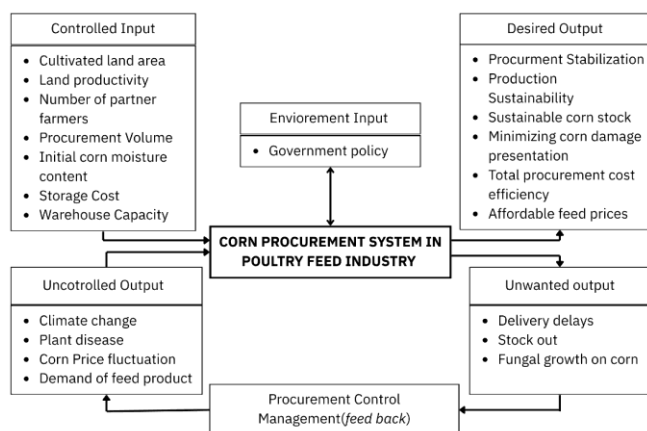


Figure 2. Input and output diagram

The determination of key variables that play a role in this corn procurement system was carried out by

combining the results of a systematic literature study and the results of interviews with stakeholders in the corn procurement system in accordance with the results in Table 1. From the analysis results, several key variables in the corn procurement system in the feed industry were obtained based on each sub-model that had been determined in the system boundary illustrated in Figure 2.

Model Conceptualization

The conceptual model in this study is illustrated through a Causal Loop Diagram that explains the relationship between variables in the corn procurement system used in the poultry feed industry.

CLD Corn Supply Sub-Model

This sub-model illustrates the relationship between variables that can affect the availability of local corn in Belu Regency and the corn procurement process in the poultry feed industry. The causal loop diagram of this sub-model can be seen in Figure 3.

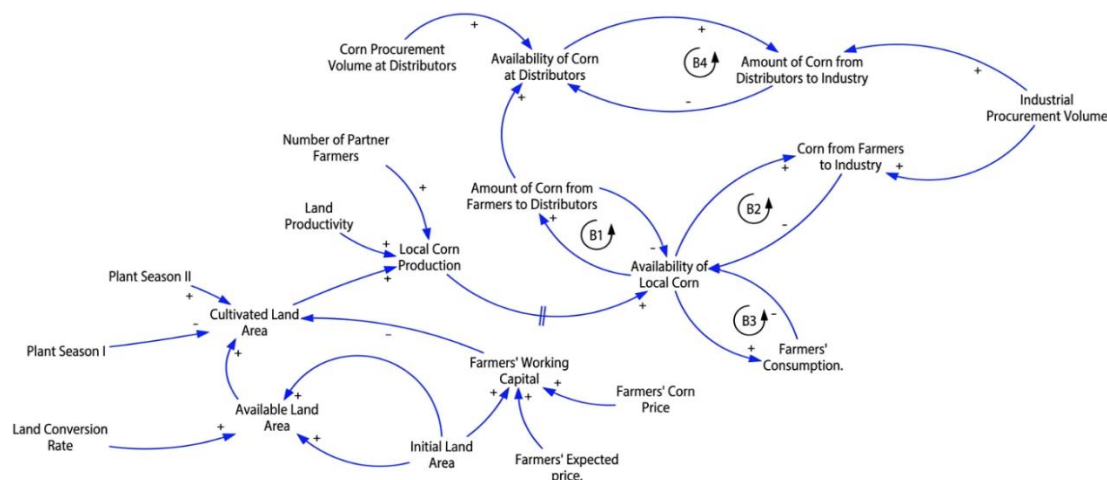


Figure 3. CLD corn supply sub-model

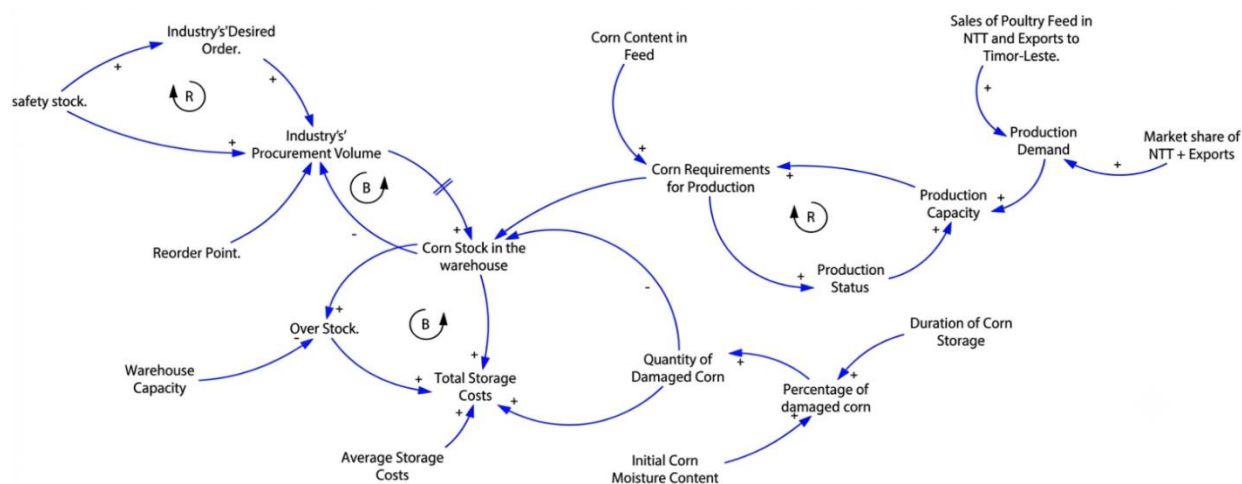


Figure 4. Corn storage sub-model

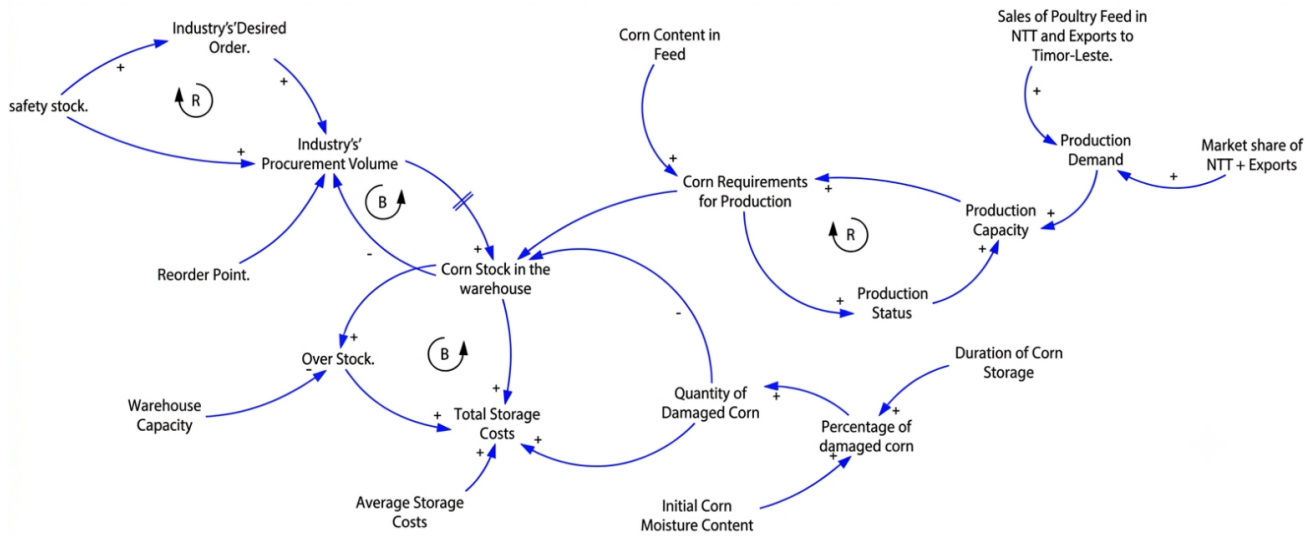
Figure 3 shows that several variables in this sub-model have a relationship with notation B, which means that the two variables must balance each other or counteract changes in order to achieve stability or equilibrium (Sternan, 2000).

CLD Corn Storage Sub-Model

Corn procurement from farmers or distributors will then enter the storage sub-model, which becomes corn stock in warehouses for the poultry feed industry. The

relation between variables that affect corn stock in warehouses can be seen in Figure 3.

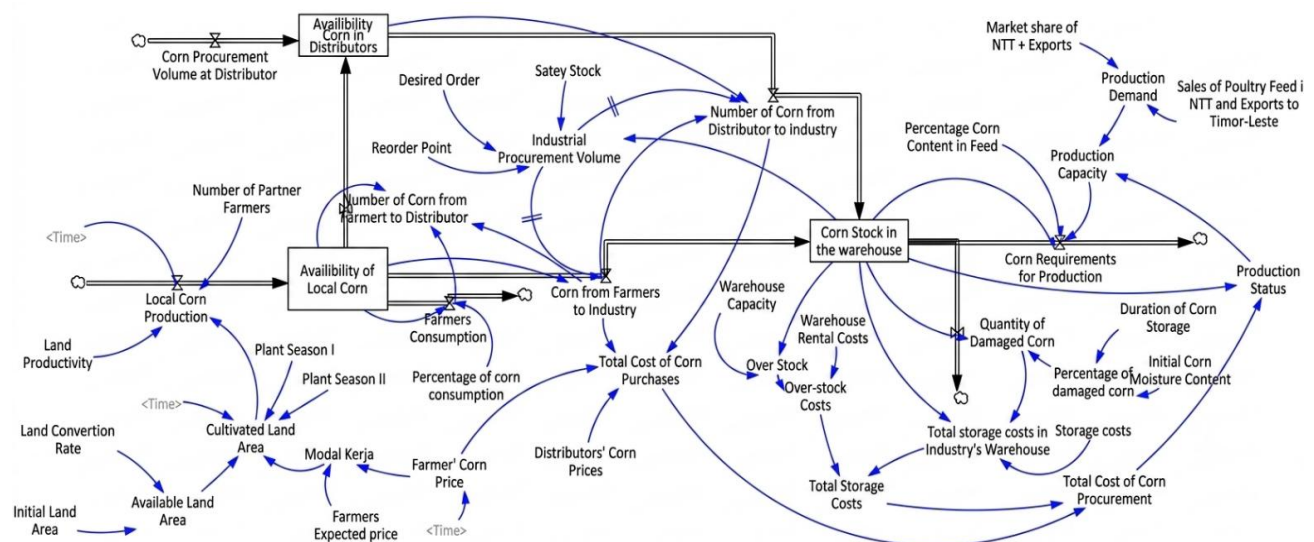
Figure 4 shows causality between variables, showing a relationship with the notation loop R, which means Reinforcing. A loop with the notation R means that the variables reinforce or amplify initial changes in the system (Dudoladov et al., 1976). The relationship between procurement volume and corn stock in the warehouse includes a delay notation, indicating that there is a delay before the corn becomes available in the warehouse (Boccardo et al., 2006).

**Figure 5.** CLD Procurement cost sub-model

CLD Procurement Cost Sub-Model

This sub-model diagram illustrates the variables that affect the overall total cost of corn procurement during the 36-month simulation period. Figure 5 shows that the total costs from the two previous sub-models

will be accumulated in this sub-model based on each variable that affects it. Several variables that incur costs are depicted in this diagram as sources of change in the total cost of corn procurement in the poultry feed industry.

**Figure 6.** Stock and flow diagram

Model Formulation

Based on the causal relationships constructed in the Causal Loop Diagram, the model further developed into a Stock and Flow Diagram. This diagram serves to describe and simulate the corn procurement system in line with the causality of each variable involved (Dudoladov et al., 1976). The mathematical formulation of each variable is designed in this stage in according with the results of the analysis of the relationships between variables and other supporting data obtained during field research (Pejić-Bach et al., 2007). The Stock

and Flow Diagram as shown in Figure 6 constructed in this study integrates all sub-models so that the relationships between variables from each sub-model can be seen, enabling comprehensive simulation.

Model Verification and Validation

In this stage, the computer model that has been constructed using Vensim PLE software is verified using the available model check and unit check modules (Sargent, 2013).

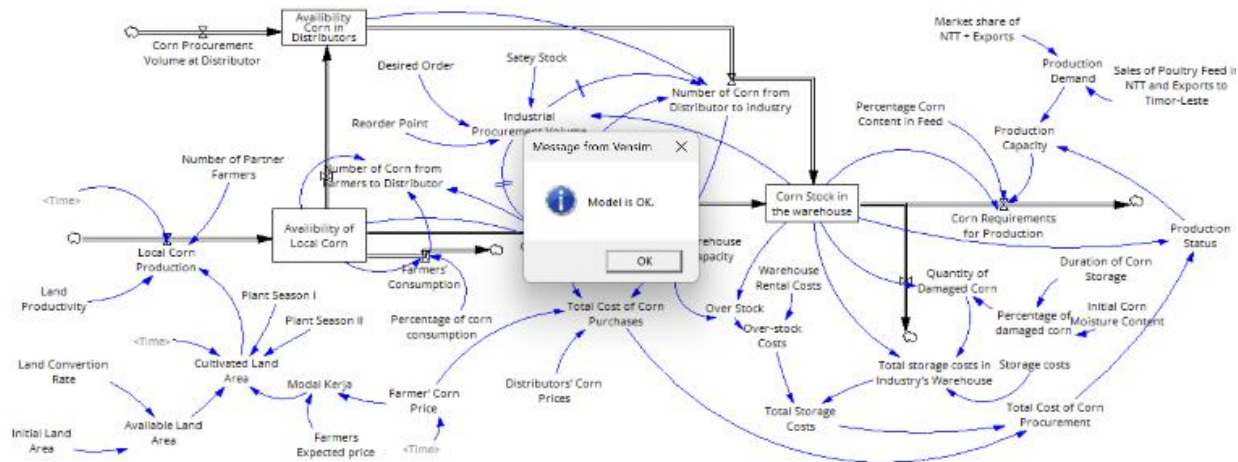


Figure 7. Model verification result

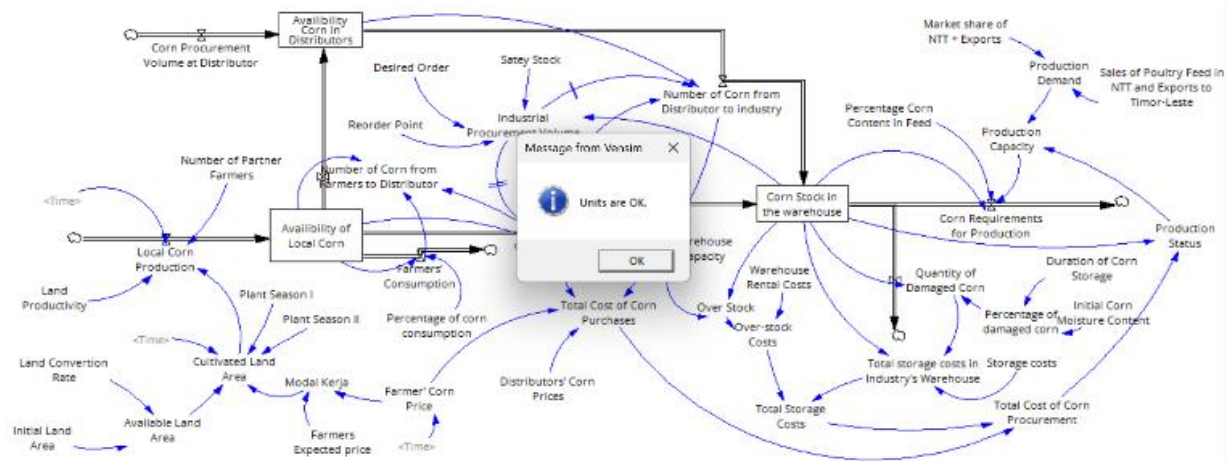


Figure 8. Unit verification result

Figure 7 shows that the verification results of the constructed computer model have no errors or faults so that simulations can be run on the model. Next, unit verification is carried out to ensure that there are no unit errors in model developed.

Figure 8 shows that the units in the constructed model are functioning correctly. These results indicate that the units given in each variable are balanced and in accordance with the logic flow of the constructed model.

Model Validation

After the structure model has been validated, a simulation is performed on the base model to obtain the output from the constructed model (Kleijnen, 1995). Since the industry is still in the planning stage and historical data is not yet available, validation testing of historical data was only performed on the corn availability sub-model by testing corn production data and corn planting area for the last three years. The data validation results are presented in Table 3.

Table 3. Result of MAPE Calculation

Variable	Year	Actual Data	Simulation Result	MAPE
Cultivated Land Area	2022	16.431	15.048	5.4%
	2023	10.117	10.080	
	2024	10.301	11.076	
Local Corn Production	2022	54.599	51.639	8.6%
	2023	33.921	34.411	
	2024	36.409	29.564	

Based on the validation results in Table 2, it can be concluded that the validated model accurately represents the real system conditions, because according to Lewis (1982), a MAPE value of less than 10% is considered accurate (Mariyana et al., 2023). Therefore, the basic model that has been developed can be used for policy formulation through various scenarios that will be tested in the next stage, such as evaluating the impact

of different policy options on system performance and stakeholder outcomes.

Model Simulation

To produce an effective and efficient procurement strategy, this simulation model focuses on the total cost of corn procurement, taking into account various risks that may occur (Andhika, 2019).

Base Model Simulation

This model is a model with a procurement system adapted to inventory management, where there are safety stock and a reorder point as control points for corn availability (Efrilianda et al., 2018). In this basic scenario, farmers act as the main suppliers of corn to the industry, and distributors are involved as substitutes for farmers when corn is not available, such as during the planting season. Figure 9 displays the simulation results of this basic scenario.

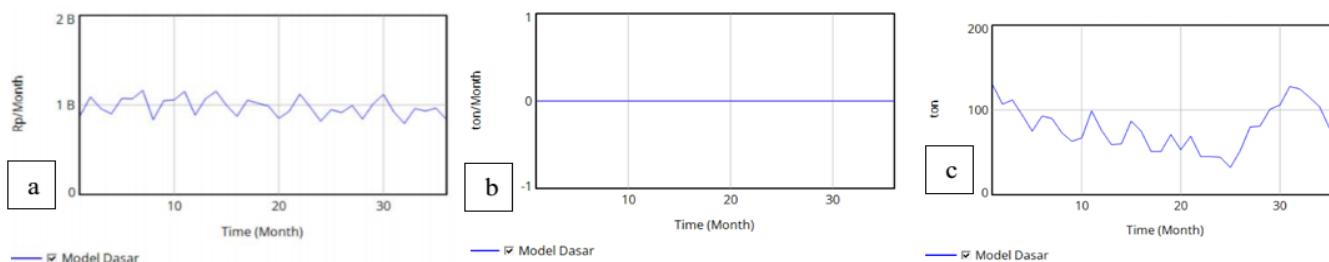


Figure 9 Results of the based model simulation a). Availability of local corn, b). Volume of corn from Farmers and Distributors, c). Overstock, d). Cost of purchasing corn

In this period of the simulation, it can be seen that the availability of corn among farmers is very fluctuating, following an unstable harvest pattern. Based on the simulation results from this basic model, the total cost of purchasing corn required by the livestock feed industry over three years is estimated to reach Rp. 35,235,697,000.

Thus, the frequency of corn procurement from distributors is higher than procurement from farmers, resulting in increased corn purchase costs during certain periods and causing fluctuations in corn procurement costs for each procurement period. Thru the implementation of procurement management such as the presence of safety stock and reorder point in this procurement system, it proves that there is neither excess nor shortage of corn during the ongoing period. This supports the realization of an efficient corn procurement system.

Scenario I

In this scenario, the government acts as a stabilizer of corn prices in order to suppress fluctuations in corn

prices. The establishment of a corn purchase price policy and the presence of the Merah Putih Cooperative or BUMDES as agents collecting harvested corn from farmers provide price certainty and corn availability for the industry. This scenario sets a base corn price of IDR 5,500 in all seasons, whether procurement is carried out from farmers or from the Merah Putih Cooperative/BUMDES.

The simulation results from this scenario indicate that the industry requires a corn procurement cost of Rp. 25,740,000 over the simulation period of 36 months. This scenario shows a total procurement cost efficiency of 26.95% for corn procurement compared to the total procurement cost in the basic model. In this scenario, procurement management is still applied as in the basic model scenario with the same volume, so there are no excesses or shortages of corn in the livestock feed industry during the production process. Stable procurement costs can affect stable product prices, thereby increasing the competitiveness of poultry feed products in the market (Moss et al., 2021).

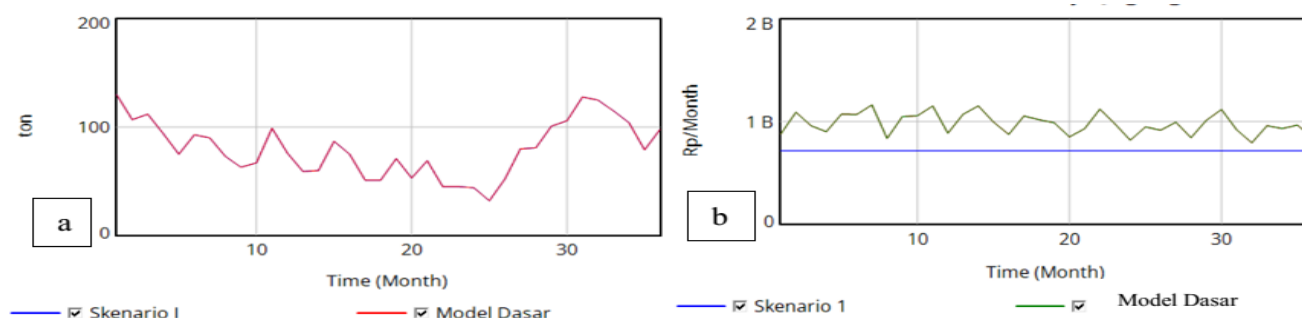


Figure 10. Simulation results of scenario I a). Corn availability in the warehouse b). Total corn purchase cost

Scenario II

This scenario describes how the industry procures corn based on the corn harvest season, which occurs every four months, to get the lowest corn price. This scenario does not utilize reorder points or safety stock based on the current calculations. The industry procures

corn based on the average monthly demand and adjusts it according to the corn storage capacity of 130 tons in its warehouse, along with the corn requirement for the next four months. Figure 11 displays the simulation results of this scenario.

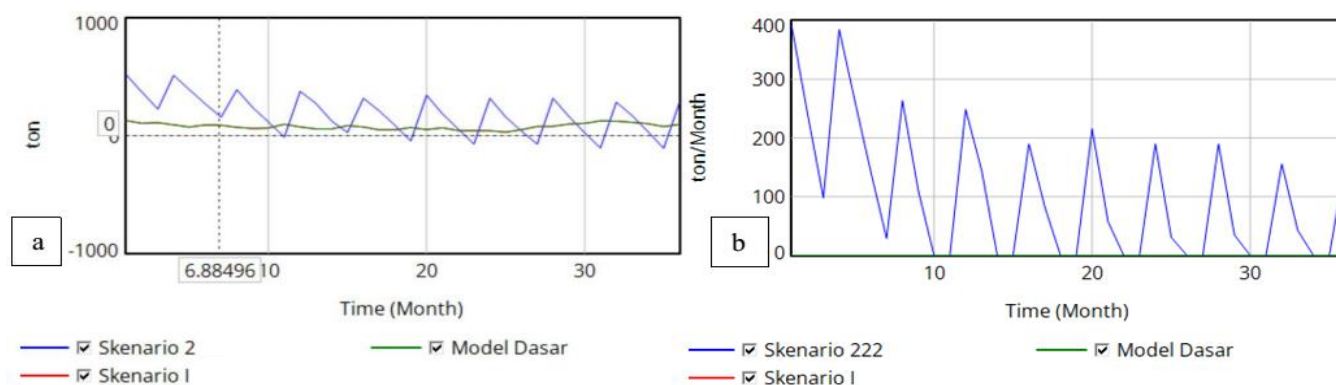


Figure 11. Results of scenario 2 simulation, a) Corn purchase cost, b) Overstock volume

Based on the simulation results in Figure 11 the total cost of corn procurement that the livestock feed industry needs to incur over 36 months is Rp. 33.143.070.000. When compared to the total procurement costs of both scenarios in the basic model, scenario II has a lower total procurement cost. This scenario shows a high risk in this corn procurement system, where there is an extremely high volume of overstock during the procurement period and stockouts occur during certain planting periods.

Evaluation of the Simulation Results of the Corn Procurement System Model

The simulation results of each scenario are then compared to obtain the recommended scenario that provides the most optimal results in the corn procurement system for the livestock feed industry in Belu Regency. The comparison of each scenario is evaluated based on the system design in the input and output system diagram that was created in the initial modelling stage, which can be seen in Table 4.

Table 4. Analysis of Scenario Implementation Based on System Indicators

Indicator	Base Model	Scenario I	Scenario II
Procurement Stabilization	Fluctuating	Stable	Unstable
Production Sustainability	Guaranteed with safety stock and reorder point	Highly guaranteed	High risk
Sustainable Corn Stock	Guaranteed with inventory management system	Most optimal, because local harvest is integrated	Unsustainable
Procurement Cost Efficiency	Fluctuating and highest price	Highly efficient and stable	Moderate and fluctuating cost
Risk of Stockout	Very low	No stockout	Very high
Shipping Delay	Variable waiting time	Lowest risk of delay	Longer lead time
Mold Growth on Corn	Low mold growth	Low mold growth	High risk

Conclusion

This study can design a dynamic system model for corn procurement in the poultry feed industry at Belu Regency. The model is designed to examine corn procurement policies in the poultry feed industry that have been tailored to regional characteristics and challenges, including seasonal trends, price volatility, and constraints in warehouse capacity. The model was verified and validated with a MAPE value below 10%. According to Lewis (1982) in (Mariyana et al., 2023) a MAPE value of less than 10% is considered quite accurate. The simulation results of these three scenarios based on the comparison of total corn purchase costs show that scenario I has the lowest procurement cost, which is Rp. 25.740.000.000, compared to the baseline model (Rp. 35.235.697.000) and scenario II (Rp. 35.143.071.000). When looking at the overstock costs, scenario II consistently incurs higher overstock costs during the simulation period. High overstock indicates that the corn stock in the warehouse exceeds the warehouse capacity over several periods, resulting in increased storage costs. This can potentially make the corn vulnerable to physical damage due to Mold, pests, and nutrient loss, which will affect the overall increase in total procurement costs. According to this analysis, Scenario I is the best foundation for policymaking because it strikes a balance between cost-effectiveness, stabilization of the corn supply, and price certainty for industry, farmers, and other stakeholders involved in the corn procurement process for the poultry feed industry in Belu Regency.

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Author Contributions

Valentina Novita Bere: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing - original draft. Elisa Anggraeni: Supervision, Validation, Methodology, Writing - review & editing. Titi Candra Sunarti: Supervision, Project administration, Resources, Writing - review & editing. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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