Available online at http://www.iorajournal.org/index.php/ijgor/index

International Journal of Global Operations Research

e-ISSN: 2722-1016
p-ISSN: 2723-1739

Vol. 6, No. 2, pp. 105-113, 2025

The Application of Dynamic Simulation for Determining Competitive Sales Strategies of Cassava Chips Using iThink

Muhammad Falleryan[1], Axel Juanito[2], Dimas Nurcahya[3], Eneng Tita Tosida[4*], Kotim Subandi[5], Victor Ilyas Sugara[6]

[1,2,3,4,5,6] *Department of Computer Science, Universitas Pakuan, Bogor, Indonesia*

**Corresponding author email: enengtitatosida@unpak.ac.id*

Abstract

This study aims to determine sales strategies for cassava chips through a dynamic simulation approach using iThink software. The simulation is used to model the factors influencing sales performance, such as fluctuations in raw material prices, operational costs, and market demand patterns. By employing a CLD (Causal Loop Diagram) model and dynamic simulation, this research evaluates various strategies, including product diversification, digital promotion, and distribution efficiency. The simulation results indicate that implementing strategies such as flavor variant diversification and increased promotion through social media can significantly improve sales and profits. Validation was carried out through sensitivity testing on cost and sales parameter changes, demonstrating that dynamic simulation can be an effective tool to support data-driven strategic decision-making

Keywords: Dynamic simulation, sales strategy, cassava chips, iThink, CLD model

1. Introduction

The cassava chips industry in Indonesia faces various challenges, ranging from fluctuations in raw material prices to high operational costs. In addition, increasing competition in the local market and unstable demand patterns are key factors that hinder profitability. These conditions are further exacerbated by limited marketing and distribution strategies, which have yet to fully capitalize on the market's potential. In an increasingly competitive environment, cassava chip producers must develop appropriate strategies to survive and grow in the market.

To address these issues, a strategic approach is needed—one that can map the relationships between variables such as production costs, demand patterns, and promotional effectiveness. Product diversification and the use of digital promotion are key solutions for increasing product appeal and improving marketing cost efficiency. Furthermore, optimizing the distribution system is designed to expand market reach at lower costs, thereby supporting sustainable sales growth. Selecting an effective competitive strategy requires a deep understanding of the various factors that influence sales, such as pricing, promotion, distribution, and consumer behavior. Therefore, a supporting tool is needed that can comprehensively model the dynamics of the business system. One such approach is dynamic simulation using the iThink software.

iThink is a system dynamics-based software that enables the modeling of various business scenarios to understand the long-term impacts of strategic decisions. By using dynamic simulation with iThink, this approach can provide a comprehensive overview of how these factors interact with one another. Dynamic simulation offers several advantages, such as the ability to test multiple scenarios without real-world risk, more accurate data-driven analysis, and in-depth strategy evaluation. This approach also enables companies to make more measurable and effective strategic decisions, thereby supporting sustainable business development amid dynamic market challenges. This research aims to achieve a dynamic system of cassava chips sales performance using dynamic simulation to evaluate competitive sales strategies through iThink.

2. Literature Review

The text is to be typeset in 11 pt Times Roman, single spaced etc.

3. Materials and Methods

3.1. Materials

3.1.1. Simulation Modeling

Dynamic simulation is a method used to model and analyze the behavior of complex systems using computers. This method enables the testing of various scenarios and strategies in a safe and controlled environment. Dynamic simulation can be utilized to predict the outcomes of strategic decisions and assist companies in determining the most effective courses of action.

3.1.2. Sales Strategy

Sales strategy refers to a set of strategic steps taken by companies to increase sales volume and gain a competitive advantage in the market. According to Dharma (2023), innovation in product development, such as flavor variety and packaging design, plays a vital role in attracting consumer interest. Moreover, Syamsuri (2024) emphasize that the use of digital platforms, including social media and e-commerce, can expand market reach while enhancing marketing process efficiency. Digital-based approaches also enable more active interaction between companies and consumers, ultimately fostering increased customer loyalty. This aligns with findings by Ketkaew (2024), which reveal that managing customer relationships through digital platforms not only improves customer retention but also contributes to repeat purchases. Such strategies are particularly relevant for cassava chip products, where product diversification, optimized distribution, and digital promotion are key elements in enhancing competitiveness in a dynamic market.

3.1.3. iThink

iThink is a simulation software used to model dynamic systems through a visual approach using Data Flow Diagrams (DFD) and flowcharts. This software facilitates the design, testing, and analysis of system models effectively while providing informative reports. One of iThink's strengths lies in its capability to simulate various scenarios to support data-driven decision-making. The use of iThink has been applied in several studies, including research by Tsaples and Tarnanidis (2020), who utilized iThink to model supply chains and analyze the impact of extreme events. Their study demonstrated that iThink can provide deep strategic insights and assist in designing systems that are more adaptive to change.

3.1.4. CLD Model (Causal Loop Diagram)

The CLD model is a fundamental tool in dynamic simulation that maps cause-and-effect relationships within a system. According to Crielaard et al. (2024), this diagram helps identify interactions among variables and feedback patterns that influence system performance, making it a valuable tool for data-based business strategy planning.

3.1.5. Product Diversification

Product diversification is a strategy aimed at creating variety in product offerings to meet diverse consumer preferences. According to Pamungkas (2024), diversifying flavors and packaging in local products such as cassava chips has proven to enhance competitiveness in both domestic and international markets.

3.1.6. Digital Promotion

Digital promotion includes the use of social media and online platforms to reach a broader audience. A study by ASI (2022) shows that digital promotion can increase product exposure and accelerate the marketing process at a lower cost compared to traditional methods.

3.1.7. Model Validation

Validation in dynamic simulation aims to ensure that the model accurately represents the real system. Research by Shaik (2021) indicates that sensitivity testing on variables such as cost and demand can enhance model accuracy and support better strategic decision-making.

3.1.8. Competitive Strategy Using Dynamic Simulation

Dynamic simulation enables companies to map out various competitive strategies that are adaptable to market changes. According to Lin and Wang (2020), this approach can be used to identify optimal strategies in addressing operational challenges such as demand fluctuations and pricing pressures. Their research shows that data-driven

simulation accelerates the evaluation process and supports strategic decision-making. This study also considers the impact of digital promotion. The model is built based on primary and secondary data to generate relevant and realistic simulations, following the stages described below.

3.2. Methods

3.2.1. Research Stages

1) Problem Identification
   This stage involves identifying the factors that influence cassava chip sales, focusing on fluctuations in raw material prices, production costs, and market demand patterns. The issues are gathered through literature reviews and interviews with small and medium-sized cassava chip business owners.
2) Data Collection
   Primary data are obtained through interviews and surveys conducted with cassava chip producers and consumers. Secondary data come from journals, market reports, and related documents to support the simulation model. Key variables collected include raw material prices, promotional costs, consumption patterns, and sales volume.
3) Development of the CLD Model
   A Causal Loop Diagram (CLD) model is used to illustrate the dynamic relationships among key variables. This diagram helps map out cause-and-effect relationships, such as how promotion influences demand and how raw material price fluctuations affect profit margins.
4) Model Implementation in iThink
   The developed CLD model is implemented using the iThink software to facilitate simulation. Flow diagrams are created to represent system dynamics in greater detail, allowing users to test various sales strategy scenarios.
5) Model Validation and Simulation Analysis
   The developed model is validated through sensitivity analysis to ensure predictive accuracy. The analysis is conducted by testing scenarios such as changes in raw material prices, increased promotional costs, or variations in consumer demand levels.

4. Results and Discussion

4.1. Problem Identification

The cassava chip industry operated by UD. XYZ is facing challenges in improving profitability. Data indicates that revenue often fails to fully cover expenses, resulting in initial losses. Moreover, product demand and sales have yet to reach their full potential, despite a significant market opportunity.

Main Problems:

1) Expenses are too high relative to revenue.
2) Low profitability due to suboptimal marketing and distribution strategies.
3) Production and sales have not yet reached a scale that can generate substantial profits.

According to Comstock (2019), *"Marketing work is never finished. It's about perpetual motion. We must continue to innovate every day."*

4.2. Data Collection

This research utilizes both primary and secondary data. Data collection techniques include observation, interviews, and documentation, are given in Table 1.

Table 1. Average Demand and Production

No	Description	Amount
1	Demand	3,842.31
	~ 5 Flavor Variants (Probability)	40%
	~ Orders	100
	~ Number of Stores	38
2	Production	3,842.31
3	Sales	3,727.04
4	Selling Price per Unit	45,000

5	Raw Materials Cost	IDR59,075,440
	~ Raw Materials (Pcs)	35843
	~ Packaging (Pcs)	5000
6	Shipping Cost	IDR 867,842
	~ Number of Deliveries	115
	~ Fixed Shipping Cost	IDR 20,000
7	Revenue	IDR 63,135,493
8	Expenditure	IDR 61,028,308
	~ Staff	432888
	~ Operational	1519980
9	Marketing	IDR 6,313,549
10	Net Income	IDR 8,832,506
11	Profit	IDR 6,527,118

The collected data includes:

- Demand:
  The average demand reaches 3,842.31 units, with diversification into 5 flavor options (probability of 40%). A total of 100 orders were placed through 38 stores that distribute the product.
- Production:
  The average production equals the demand, amounting to 3,842.31 units, reflecting a balance between production and market needs.
- Sales:
  The average sales reached 3,727.04 units, with a selling price of IDR45,000 per unit.
- Production Costs:

  The total cost of raw materials amounted to IDR 59,075,440, which includes 35,843 pcs of raw materials and 5,000 pcs of packaging. Shipping costs reached Rp 867,842, with 115 deliveries and a fixed cost of IDR 20,000 per delivery.
- Revenue:
  Gross revenue from sales reached IDR 63,135,493.
- Expenditure:
  Total business expenditure was IDR 61,028,308, consisting of staff salaries amounting to IDR 432,888 and other operational costs of IDR 1,519,980.
- Marketing:
  Marketing costs were allocated at IDR 6,313,549, approximately 10% of the total gross revenue.
- Profit:
  Net income after deducting all expenses amounted to IDR 8,832,506, with a net profit of IDR 6,527,118.

4.3. Model Development CLD (Causal Loop Diagram)

This model is designed to illustrate the dynamic interactions that influence business performance, ranging from revenue and expenditure aspects to expansion strategies. The following is the result of the development of the Causal Loop Diagram model.

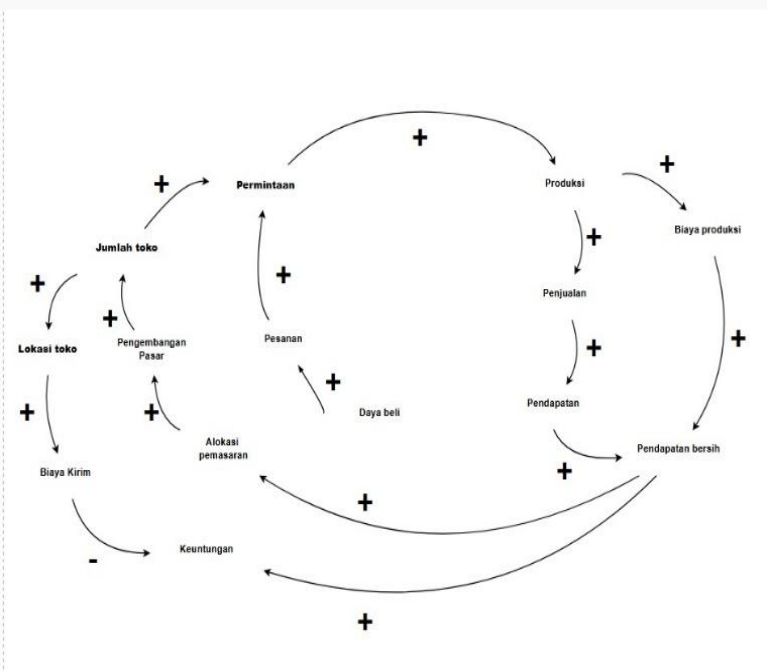

Figure 2: Causal Loop Diagram (CLD) Model

The CLD model is used to map the relationships between key variables within the system. Revenue is influenced by sales and selling price. Expenditures consist of fixed costs (salaries, operations) and variable costs (raw materials, transportation). An increase in the number of stores raises demand, which subsequently drives production and sales. Production is influenced by demand, which is driven by purchasing power and marketing. Profit is the difference between revenue and expenses.

1. **Main Loop – Reinforcing Loop**
   Increase in stores → increase in demand → increase in production → increase in sales → increase in revenue.
2. **Balancing Loop**
   Expenses increase along with production, which may reduce profits if not balanced by increased revenue. According to Harahap (2025), "Business model validation is carried out using the initial BMC source, which is then developed through business idea testing analysis."

4.4. Model Implementation in iThink

This dynamic model is implemented using iThink software to visualize the relationships between key variables in the business system. The following is the result of the model implementation in iThink:

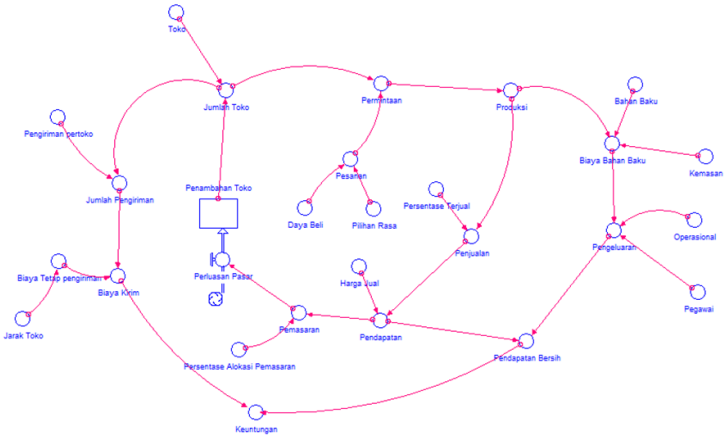

Figure 3: Model Implementation in iThink

This model is built by considering the following relationships:

1. Production and demand are linked to illustrate the relationship between market demand and production capacity.
2. Revenue is calculated based on sales volume and unit selling price.
3. Expenses are calculated as the sum of fixed and variable costs.
4. Profit is obtained from the difference between revenue and expenses.

Store expansion is calculated based on the effectiveness of marketing activities.

4.5. Model Validation and Simulation Analysis

The validation step in this simulation is conducted to ensure that the developed model reflects the actual operational conditions of the cassava chips industry at UD. XYZ. Validation involves comparing actual data with the simulation results, particularly for key variables such as revenue, expenses, and profit.

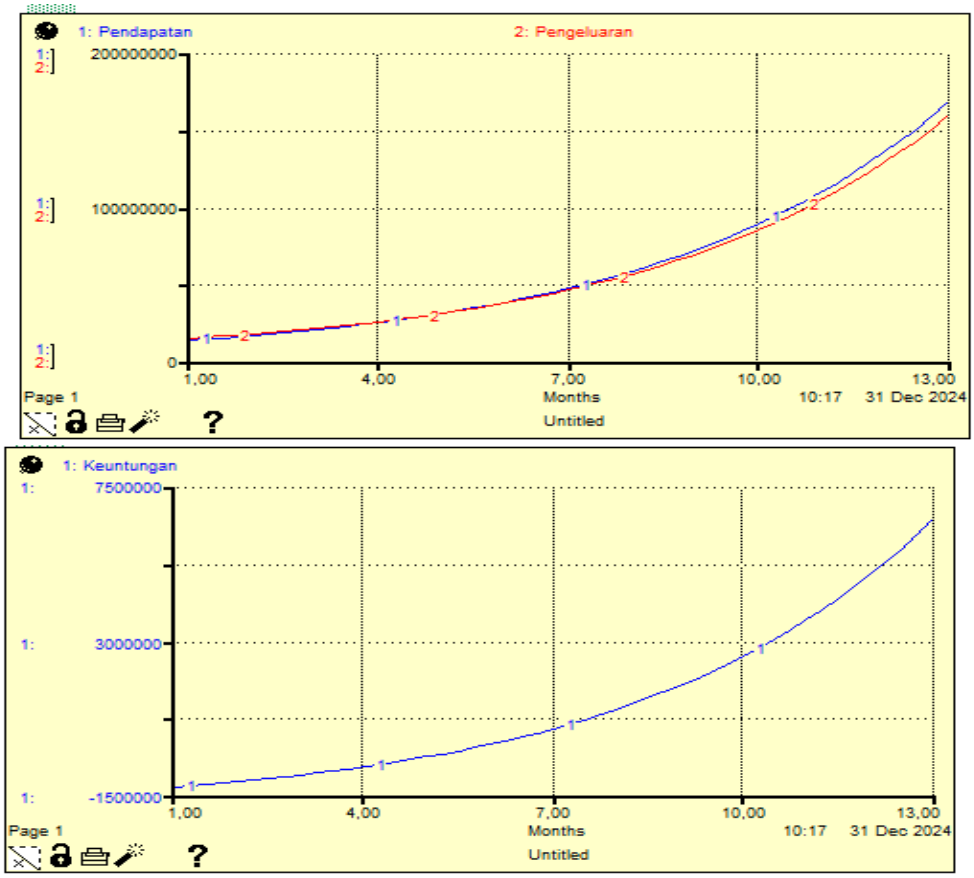

Figure 5: Expenditure Graph

Initial profits were negative but showed a steady upward trend from month to month, reaching a positive value by the sixth month. Revenue increased exponentially, reaching Rp167,716,985.52 by the 12th month. Expenditures also rose, but at a slower rate than revenues after the sixth month. The number of stores continued to increase, reaching 35.42 stores by the 12th month. Demand and sales demonstrated stable growth in line with store expansion and marketing efforts.

4.6. Analysis

The increase in profit after the sixth month indicates the effectiveness of marketing strategies and sales growth. The upward trend in demand and sales shows that the market is starting to respond to expansion and promotional strategies. The relatively stable increase in expenditures suggests that the system is becoming more efficient in managing both variable and fixed costs. The financial performance simulation of the UD. XYZ cassava chips industry shows that the company experienced losses during the first four months. In the first month, the loss amounted to Rp1,290,768.00, gradually decreasing to Rp1,134,001.92 in the second month, Rp940,118.17 in the third month, and Rp700,328.37 in the fourth month. By the fifth month, the loss decreased further to Rp403,763.31 and nearly broke even with a loss of Rp36,980.23 in the sixth month. Profit began to appear in the seventh month with a positive value of Rp416,646.44. From there, profits continued to rise significantly, reaching Rp977,678.76 in the eighth month, Rp1,671,547.27 in the ninth month, and Rp2,529,703.72 in the tenth month. A sharper increase occurred from the eleventh to the thirteenth months, with profits of Rp3,591,046.73, Rp4,903,685.00, and Rp6,527,117.96 respectively.

This profit growth is supported by several key factors such as consistent revenue growth, efficiency in operational cost management, and an increase in the number of stores which expanded market reach. Revenue rose from Rp13,095,000.00 in the first month to Rp167,716,985.52 in the 12th month, highlighting the effectiveness of marketing and market expansion strategies. The addition of stores, reaching 35.42 by year-end, also played a critical role in driving demand and sales. As Fishburne (2019) stated, “The best marketing doesn’t feel like marketing.”

4.7. Blackbox Testing

Blackbox testing for this system was conducted to ensure that every function operates as expected without examining the internal code structure. This testing includes evaluation of inputs and outputs for each major system component, based on scenarios designed to simulate real-world conditions. The following diagram illustrates the blackbox testing process flow, which includes environmental inputs, controlled and uncontrolled inputs, and the final evaluation outcomes.

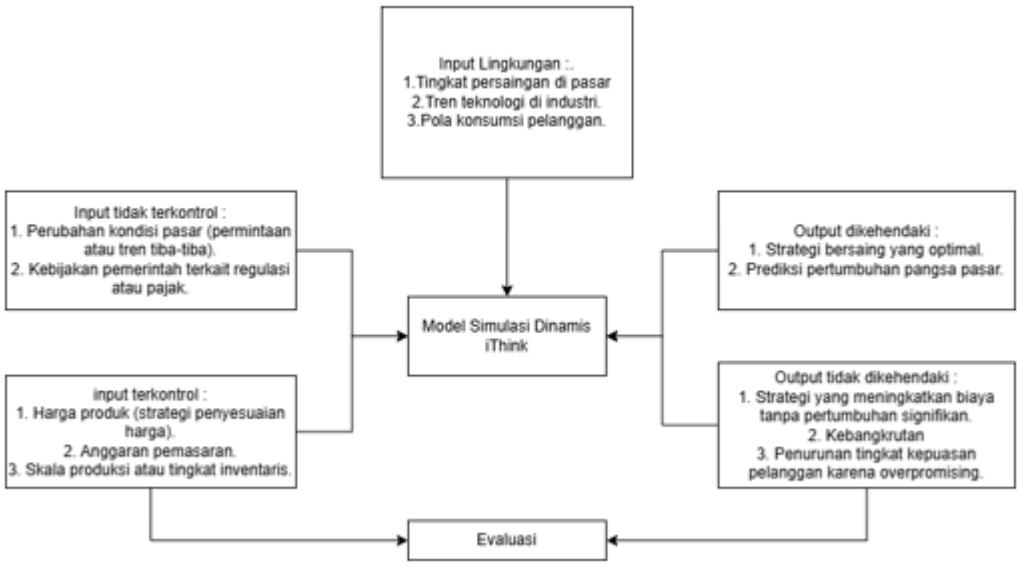

Figure 6: Blackbox Testing Diagram

Variability is influenced by customer preferences, government policies, and regulatory or tax changes that may impact production and distribution costs.

4.7.1. Dynamic Simulation Model in iThink

iThink was utilized as a tool to process all available inputs. This model enables the analysis of relationships between internal factors (such as production and marketing) and external factors (such as demand and regulations). The results of the analysis help the organization to determine optimal strategies to improve profitability and operational efficiency. This approach supports organizations in formulating more effective and adaptive strategies in response to changing business environments (Andhika, L. R., 2019).

4.7.2. Desired Outputs

These include simulation results expected to support the success of the organization's strategy. In this simulation, the desired outputs include:

1. Optimal Profit: A recorded increase in net profit amounting to Rp6,527,118.
2. Market Growth: An increase in the number of stores distributing the product, averaging 38 stores.

4.7.3. Undesired Outputs

Undesired outputs include simulation results that may harm the organization, such as:

1. High Costs: Strategies that lead to increased expenses without adequate revenue growth.
2. Declining Customer Satisfaction: Inability to meet market demand or customer expectations due to excessive strain on operations.

4.7.4. Evaluation

This final stage ensures that the strategies implemented align with the organization's objectives. Based on the simulation results, UD. XYZ can identify potential risks such as high operational costs during the initial period. This analysis allows the company to adjust its marketing, distribution, and production strategies in order to achieve more consistent profitability in the future.

5. Conclusion

The simulation results of the dynamic model for the cassava chips industry, UD. XYZ, indicate that the company experienced losses during the first four months, with the highest loss reaching Rp1,290,768.00 in the first month. However, the implementation of appropriate marketing strategies and cost management successfully reversed the situation, leading to a profit starting in the sixth month of Rp416,646.44, which continued to grow to Rp6,527,117.96 by the thirteenth month. These findings affirm that a dynamic simulation approach can assist in designing adaptive and data-driven business strategies. The strategies implemented namely product diversification, digital promotion, and distribution efficiency—proved effective in enhancing business performance. Diversification of flavor variants increased consumer appeal, while digital promotion allowed for broader marketing reach at a relatively low cost. Meanwhile, distribution optimization ensured product availability in the market, thereby stimulating demand and sales growth. The synergy of these three strategies successfully improved operational efficiency and expanded market share. For further development, it is recommended that the simulation model include additional external variables such as competitor strategies or economic policy changes that may impact the market. Moreover, the company should periodically validate the model's performance to ensure that the applied strategies remain relevant amid evolving market dynamics. This study demonstrates that data-driven decision-making through dynamic simulation is a critical step toward building a sustainable and profitable business.

Acknowledgments

The authors would like to express their sincere gratitude to the Computer Science Department, Faculty of Mathematics and Natural Sciences, Pakuan University, for the support and resources provided throughout the development of this research.

References

ASI, Y. S., Sundari, A., & SUSANTO, H. (2022). The Influence Of Local Content Towards The Sales Of SMEs Product Through Media Of Market Place. *Journal of Tourism Economics and Policy*, *2*(2), 51-62.

BFI Finance. (n.d.). "Kiat Sukses Usaha Keripik Singkong: Tips, Modal, dan Strategi Pemasaran." https://www.bfi.co.id/id/blog/kiat-sukses-usaha-keripik-singkong

Chesky, B. (2019). Bangun sesuatu yang disukai 100 orang, bukan sesuatu yang disukai 1 juta orang. https://www.affmu.com/id/marketing-quotes-1.html

Comstock, B. (2019). Pekerjaan pemasaran tidak pernah selesai. Ini tentang gerakan abadi. Kita harus terus berinovasi setiap hari. https://www.affmu.com/id/marketing-quotes-1.html

Crielaard, L., Uleman, J. F., Châtel, B. D., Epskamp, S., Sloot, P., & Quax, R. (2024). Refining the causal loop diagram: A tutorial for maximizing the contribution of domain expertise in computational system dynamics modeling. *Psychological methods*, *29*(1), 169.

Dharma, B. A., Hermawan, A., & Suharsono, N. (2023). Development of Innovative Packaging Design for Madura Cassava Chips to Improve Product Competitiveness. *Economics and Business Journal (ECBIS)*, *2*(1), 39-50.

Fishburne, T. (2019). Pemasaran terbaik tidak terasa seperti pemasaran. https://www.affmu.com/id/marketing-quotes-1.html

Harahap, A. S. R., Yusrizal, Y., & Syahbudi, M. (2025). Sustainability Analysis of Craft Business in Mekar Sari Village, Asahan Regency: An Islamic Economic Review. *AL-FALAH: Journal of Islamic Economics*, *10*(01), 79-106.

Ketkaew, C., Oktaviani, R. D., Padthar, S., Leeanansaksiri, R., Meethonglang, T., & Hanna, A. (2024). Enhancing sustainable food innovation through consumer participatory co-creation: A case study on plant-based dietary snack bars in Thailand. *Future Foods*, *10*, 100433.

Lin, T., & Wang, J. (2020). Dynamic Simulation for Competitive Strategy in Emerging Markets. *International Journal of*

Business Strategy, 18(4), 89–102.

Pamungkas, S. D., Pratiwi, D. I., Rahmadani, P. A., & Winanto, A. R. (2024). The Potential of Cassava Processing as an Alternative Food Diversification Substitute for Rice. *Jurnal Inovasi dan Pengembangan Hasil Pengabdian Masyarakat*, *2*(2), 289-307.

Safdari, N. S., Safdari, M. S., & Safdari, M. S. (2021). System Dynamics Modeling in Additive Manufacturing Supply Chain. *Processes*, *9*(6), 982.

Shaik, A. S., & Dhir, S. (2021). Dynamic modeling of strategic thinking for top management teams and its impact on firm performance: a system dynamics approach. *Journal of Management Development*, *40*(6), 453-485.

Syamsuri, A. R., Nasution, S. L. A., Syahmewah, R., Herawati, P., & Majidah, H. (2024). Training and Development of Cassava Chips MSMEs in Lingga Tiga Village: Efforts to Increase Capacity and Competitiveness of Local Products. *International Journal of Community Service Implementation*, *2*(3).

Tsaples, G., & Tarnanidis, T. (2020). A System Dynamics Model and Interface for the Simulation and Analysis of Milk Supply Chains. Advances in Business Strategy and Competitive Advantage, 311-332.