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Kaizen Costing and Financial Performance of Sugar Companies in Kenya: The Moderating Effect of Financial Leverage

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Abstract

Kaizen costing is an important cost-management approach for organisations seeking to improve operational efficiency and financial performance. The technique focuses on continuous improvement of production processes, cost reduction and efficient utilisation of organisational resources. The study examined the effect of Kaizen costing on financial performance of sugar companies in Kenya and the moderating effect of financial leverage on this relationship. The study was guided by Learning Curve Theory and Profit Maximisation Theory and adopted a longitudinal research design. The unit of analysis comprised 12 sugar companies in Kenya, while the unit of observation consisted of audited financial statements and annual reports for the period 2014–2024. A census approach was used to include all the identified sugar companies. Secondary data were collected from audited financial statements and annual reports and analysed using descriptive statistics, panel regression and hierarchical regression with the aid of STATA software. Financial performance was measured using return on assets (ROA), while financial leverage was included as the moderating variable. The random-effects regression results indicated a positive and statistically significant effect of Kaizen costing on financial performance ($\beta = 0.0079$, $p = 0.028$). The model reported an R-squared value of 0.1533, indicating that Kaizen costing accounted for 15.33% of the variation in ROA. The hierarchical regression results also indicated a negative coefficient for the interaction between Kaizen costing and financial leverage. However, the reported interaction coefficient, standard error and p-value require verification before a definitive conclusion can be made regarding moderation. The study concludes that Kaizen costing is relevant to the financial performance of sugar companies in Kenya. It recommends that sugar companies strengthen continuous cost-improvement practices, employee participation and monitoring of production processes.

Keywords: Kaizen costing, financial leverage, financial performance, return on assets, sugar companies

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Introduction

Financial performance is a key indicator of an organisation's ability to utilise its resources efficiently and generate returns. It provides a basis for assessing an organisation's financial position, operational efficiency and sustainability. Financial performance is influenced by several factors, including capital structure, cost-management practices and resource utilisation. Common measures include return on assets (ROA) and return on equity (ROE) (Dinh & Pham, 2020). This study uses return on assets to measure financial performance because it indicates how effectively a company generates earnings from its asset base.

One of the cost-management approaches adopted by manufacturing firms to improve operational efficiency and financial performance is Kaizen costing (Tasie et al., 2026). Originating in Japan, Kaizen costing is based on continuous and incremental improvement of organisational processes, with the objective of reducing production costs while maintaining product quality. It emphasises employee participation, waste reduction, process improvement and efficient utilisation of resources (Yiğit, 2022). Through these practices, firms seek to identify opportunities for cost savings and improve the efficiency of routine production activities.

Kaizen costing is particularly relevant to manufacturing companies because production costs directly influence operating efficiency and profitability. In the sugar-manufacturing sector, expenditure on sugarcane, labour, energy, machinery maintenance and processing activities constitutes a substantial part of production costs. Inefficiencies in these areas can increase operating expenses and constrain financial performance. Continuous improvement in production processes may therefore provide opportunities for reducing costs, improving resource utilisation and enhancing returns from company assets.

The relevance of effective cost management is evident in the challenges facing the sugar industry in Kenya. The sector has experienced high production costs, inadequate sugarcane supply, processing inefficiencies and substantial debt obligations. The Government of Kenya has identified these constraints as major factors affecting the performance and sustainability of the industry (Republic of Kenya, Ministry of Agriculture and Livestock Development, 2023). These challenges create a need for cost-management approaches that can

improve production efficiency and strengthen the financial position of sugar companies.

Financial leverage may also influence the extent to which improvements in cost management translate into financial performance. It represents the extent to which a company finances its operations and investments through debt. Debt financing may provide resources for acquiring machinery, improving production technology and supporting operational improvements. However, high leverage may increase interest expenses and debt-servicing obligations, potentially reducing the financial benefits generated through cost-reduction initiatives. Consequently, the effect of Kaizen costing on financial performance may vary depending on the level of financial leverage.

Despite the potential contribution of Kaizen costing to manufacturing efficiency, empirical evidence on its effect on financial performance among sugar companies in Kenya remains limited. Tasie et al. (2026) and Chuku et al. (2023) examined the relationship in manufacturing contexts outside Kenya, while Jibrin and Maccarthy (2022) reported differing results depending on the financial-performance measure used. In the sugar sector in Kenya, Colletah et al. (2024) investigated broader cost-accounting management practices among public sugar-manufacturing firms but did not isolate the specific contribution of Kaizen costing. Moreover, the moderating role of financial leverage in the relationship between Kaizen costing and financial performance has not been sufficiently established in this sector.

The existing evidence therefore leaves uncertainty about whether Kaizen costing improves the financial performance of sugar companies in Kenya and whether financial leverage strengthens or weakens this relationship. This study examined the effect of Kaizen costing on the financial performance of sugar companies in Kenya, measured by return on assets, and established the moderating effect of financial leverage on the relationship.

Literature Review

Theoretical Review

Learning Curve Theory

Learning Curve Theory explains that production costs may decline as employees and organisations gain experience in performing production activities. Repeated production enables workers to acquire skills, improve efficiency and identify better ways of completing tasks. Wright (1936) applied learning curve principles to industrial production and demonstrated declining labour costs as cumulative output increased. Arrow (1962) explains how accumulated production experience improves productivity through learning by doing.

The theory supports Kaizen costing because continuous employee learning and experience can improve production efficiency, reduce errors and minimise labour and material costs. Zangwill and Kantor (1998) explain how learning cycles contribute to continuous improvement in organisational processes. In the context of sugar companies, the theory provides an explanation of how repeated production activities, employee experience and process improvements may contribute to reductions in production costs and improved utilisation of resources.

Profit Maximisation Theory

Profit Maximisation Theory is based on the assumption that firms seek to maximise profits through efficient

utilisation of resources and management of operating costs. Profit maximisation is an important objective of business organisations because it influences decisions relating to production, investment and resource allocation. The theory explains the importance of controlling production costs while maintaining the capacity to generate revenue.

The theory supports the current study by explaining why sugar companies seek to reduce production costs and improve the utilisation of resources to enhance profitability. Kaizen costing is therefore considered a cost-management approach that may support the profit-maximisation objective through continuous cost reduction and operational efficiency.

Empirical Literature Review

Effect of Kaizen Costing on Financial Performance

Kaizen costing promotes continuous improvement, employee participation and systematic cost reduction to enhance operational efficiency and organisational profitability. Empirical studies have examined its contribution to manufacturing performance, although findings vary across industries and financial-performance indicators.

In Nigeria, Tasie et al. (2026) examined seven listed food-products manufacturing companies and established that cost-reduction rates significantly influenced financial performance, whereas target-cost achievement had an insignificant effect. Similarly, Jibrin and Maccarthy (2022), studying nine listed manufacturing companies, found that Kaizen costing had a significant relationship with return on equity but an insignificant relationship with return on assets. These findings suggest that the effect of Kaizen costing may depend on the specific practices adopted and the financial-performance measure used.

Evidence from other manufacturing contexts demonstrates positive performance outcomes. Atta-Ankomah et al. (2022) established that Kaizen implementation significantly improved sales and profits among manufacturing enterprises in Ghana, although the benefits varied with firm size and implementation capacity. Elee (2025) also found that Kaizen costing significantly influenced return on assets among manufacturing companies in Nigeria. Similarly, Jayeola et al. (2012) established a significant relationship between Kaizen cost-management practices and profitability among small and medium-sized enterprises in Nigeria. In Turkey, Yiğit (2022) demonstrated how Kaizen costing could identify production-cost reduction opportunities to achieve targeted profits in a plywood-manufacturing enterprise.

Beyond financial outcomes, Chotaliya et al. (2026) identified performance improvement, cost-management integration and problem-solving capabilities as important enablers of Kaizen implementation in manufacturing firms. This suggests that organisational capacity influences the effectiveness and sustainability of continuous improvement practices.

In Kenya, Colletah et al. (2024) examined cost-accounting management practices among public sugar-manufacturing firms in the Lake Region Economic Block. The study established a significant effect of these practices on financial performance.

Therefore, most of the reviewed studies were conducted outside Kenya, while the Kenyan studies largely examined broader cost accounting or financial management practices rather

than Kaizen costing specifically. The following null hypothesis was therefore formulated:

H_{o1}: *Kaizen costing has no statistically significant effect on the financial performance of sugar companies in Kenya.*

Moderating Role of Financial Leverage

Financial leverage represents the use of debt financing to support organisational assets and operations. Its influence on financial performance depends on whether returns generated from borrowed funds exceed associated financing costs. Consequently, leverage may influence how operational savings and efficiency improvements translate into financial performance.

Onoja et al. (2026) examined the moderating effect of leverage on the relationship between asset structure and financial performance among manufacturing companies in Nigeria. The findings established that leverage significantly moderated the relationship between non-current assets and economic value added but did not moderate relationships involving current and intangible assets. Similarly, Wells (2025), studying listed manufacturing firms in Nigeria, found that financial leverage positively and significantly moderated the relationship between free cash flow efficiency and firm performance. These findings demonstrate that the moderating influence of leverage may depend on the organisational relationship being examined.

Other studies have investigated the direct relationship between leverage and financial performance. Arhinful and Radmehr (2023), examining 263 companies listed on the Tokyo Stock Exchange, established that selected leverage measures positively influenced return on assets, return on equity and earnings per share. Conversely, Tesema (2024), studying manufacturing enterprises in Ethiopia, found that total debt and long-term debt negatively and significantly affected return on assets and net operating profitability. These contrasting findings suggest that the financial implications of borrowing depend on the financing structure and returns generated from debt.

In Kenya, Fwamba (2017) examined financial-management practices among sugar-manufacturing companies and established that investment, capital-structure and liquidity practices significantly influenced financial performance. Board structure also had a significant moderating influence. However, the study did not examine financial leverage as a moderator.

The reviewed studies demonstrate that financial leverage can influence financial performance and moderate relationships between organisational practices and financial outcomes. Nevertheless, these studies examined free cash flow efficiency and asset structure, respectively, rather than Kaizen costing. The present study therefore examines whether financial leverage moderates the relationship between Kaizen costing and financial performance among sugar companies in Kenya. The following null hypothesis was formulated:

H_{o2}: *Financial leverage has no statistically significant moderating effect on the relationship between Kaizen costing and the financial performance of sugar companies in Kenya.*

Methodology

Research Design

The study adopted a longitudinal research design to examine changes in Kaizen costing, financial leverage and

financial performance over time. Longitudinal research design involves repeated observations of the same units over a specified period. The design was appropriate because the study relied on financial information collected repeatedly from sugar companies.

Target Population

The study targeted 12 sugar companies in Kenya, comprising public and private sugar companies. The unit of analysis was the sugar company, while the unit of observation was the company-year financial record obtained from audited financial statements and annual reports.

Sampling Techniques and Sample Size

The study adopted a census approach to include all the 12 identified sugar companies in Kenya. The census approach was considered appropriate because the target population was relatively small and manageable. The study covered the period 2014–2024, representing 11 years of financial information. The maximum possible number of observations was therefore 132 company-year observations, subject to the availability and completeness of audited financial statements.

Data Collection Instrument

The study used a secondary-data extraction sheet to collect financial information from audited financial statements and annual reports of the 12 sugar companies in Kenya. The extraction sheet captured information relating to Kaizen costing, financial leverage and financial performance for the period 2014–2024.

Data Collection Procedure

Secondary data were collected from audited financial statements and annual reports of the identified sugar companies for the period 2014–2024. The study extracted information relating to the application of Kaizen costing, financial leverage and financial performance.

Financial performance was measured using return on assets (ROA), calculated as net income divided by average total assets.

$$ROA = (\text{Net Income} / \text{Average Total Assets}) \times 100$$

$$\text{Average Total Assets} = (\text{Opening Total Assets} + \text{Closing Total Assets}) / 2$$

Kaizen costing was treated as the independent variable. Its measurement was based on the Kaizen-costing indicator used in the study dataset. Financial leverage was treated as the moderating variable and was obtained from the financial information reported in company financial statements.

Data Analysis

Collected data were edited, coded, cleaned and entered into STATA software for analysis. Descriptive statistics were used to summarise the study variables. Panel regression analysis was used to examine the effect of Kaizen costing on financial performance. The Hausman specification test was conducted to guide the selection between fixed-effects and random-effects estimators.

Hierarchical regression analysis was used to examine the moderating effect of financial leverage. The analysis involved three steps. The first step examined the effect of Kaizen costing on financial performance. The second step introduced financial leverage into the model. The third step introduced the interaction term between Kaizen costing and financial leverage.

The first regression model was specified as: $ROA_{it} = \beta_o + \beta_1 KC_{it} + \varepsilon_{it}$

The moderation model was specified as: $ROA_{it} = \beta_o + \beta_1 KC_{it} + \beta_2 FL_{it} + \beta_3 (KC_{it} \times FL_{it}) + \varepsilon_{it}$

Where:

ROA_{it} = Return on assets for company i in year t.

KC_{it} = Kaizen costing for company i in year t.

FL_{it} = Financial leverage for company i in year t.

$KC_{it} \times FL_{it}$ = Interaction term between Kaizen costing and financial leverage.

β_o = Constant.

β_1, β_2 and β_3 = Regression coefficients.

ε_{it} = Error term.

The coefficient β_3 was used to determine whether financial leverage moderated the relationship between Kaizen costing and financial performance. A statistically significant interaction coefficient would indicate evidence of moderation, while an insignificant interaction coefficient would indicate that the study did not establish a statistically significant moderating effect.

Results

Descriptive Statistics of the Study Variables

Descriptive statistics covered financial performance, measured by return on assets (ROA), Kaizen costing and financial leverage. The mean, standard deviation, minimum and maximum values are presented in Table 1.

Table 1: Descriptive Statistics for the Study Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Financial Performance (ROA)	3.8759	12.2871	-18.3301	16.0536
Kaizen Costing	6.9210	12.5799	-16.2719	18.7586
Financial Leverage	1.4642	3.2166	-1.5802	16.6546

Table 1 shows that financial performance had a mean of 3.8759, while Kaizen costing recorded the highest mean of 6.9210. Financial leverage had a mean of 1.4642. The standard deviations were 12.2871, 12.5799 and 3.2166 for financial performance, Kaizen costing and financial leverage, respectively, indicating variation in the observations across the study variables.

Hausman Specification Test

The Hausman specification test was conducted to guide the choice between fixed-effects and random-effects estimators. The results are presented in Table 2.

Table 2: Hausman Test for Fixed-Effects versus Random-Effects Model

Variable	Fixed Effects (b)	Random Effects (B)	Difference (b – B)
Kaizen Costing	0.0047	0.0079	-0.0032

Hausman test: χ^2 (1) = 5.12; Prob > χ^2 = 0.2237.

The Hausman test results indicated a chi-square statistic of 5.12 and a probability value of 0.2237. Since the probability value was greater than the 0.05 significance level, the study failed to reject the null hypothesis that the difference in coefficients was not systematic. The random-effects estimator was therefore preferred for examining the effect of Kaizen costing on financial performance.

Effect of Kaizen Costing on Financial Performance

The first hypothesis stated that Kaizen costing has no statistically significant effect on financial performance of sugar companies in Kenya. Financial

performance was measured using return on assets. The regression results are presented in Table 3.

The regression results yielded a coefficient of 0.0079 for Kaizen costing, indicating a positive association with return on assets. The probability value of 0.028 was smaller than the 0.05 significance level. The study therefore rejected the null hypothesis and established that Kaizen costing had a statistically significant effect on financial performance of sugar companies in Kenya.

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Table 3: Regression Results for Kaizen Costing and Return on Assets

Variable	Coefficient	Standard Error	P-value
Kaizen Costing	0.0079	0.0036	0.028
Constant	0.0854	0.0864	0.323
Model Statistics			
Wald χ^2 (1)	4.83		
Prob > χ^2	0.0280		
R-squared	0.1533		

The overall model was statistically significant, as indicated by Wald χ^2 (1) = 4.83 and p = 0.028. The R-squared value of 0.1533 indicated that Kaizen costing accounted for 15.33% of the variation in return on assets, while the remaining 84.67% was attributable to factors not included in the model.

The regression model was expressed as follows:

$ROA_{it} = 0.0854 + 0.0079KC_{it} + \varepsilon_{it}$

Moderating Effect of Financial Leverage

The second hypothesis stated that financial leverage has no statistically significant moderating effect on the relationship between Kaizen costing and financial performance of sugar companies in Kenya. Hierarchical regression analysis was conducted in three steps.

Step One: Kaizen Costing without Financial Leverage

The first step examined the relationship between Kaizen costing and financial performance without including financial leverage. The results are presented in Table 4.

The results indicated a positive coefficient of 0.4279 for Kaizen costing. The probability value of 0.000 was smaller than the 0.05 significance level, indicating that Kaizen costing had a statistically significant effect on return on assets in this model. The overall model was statistically significant, with Wald χ^2 (1) = 26.37 and p = 0.0000. The R-squared value of 0.2884 indicated that the model accounted for 28.84% of the variation in return on assets.

Table 4: Hierarchical Regression Results for Kaizen Costing without Financial Leverage

Variable	Coefficient	Standard Error	P-value
Kaizen Costing	0.4279	0.0083	0.000
Constant	-0.0832	0.0688	0.226
Model Statistics			
Wald χ^2 (1)	26.37		
Prob > χ^2	0.0000		
R-squared	0.2884		

Step Two: Kaizen Costing and Financial Leverage

In the second step, financial leverage was introduced into the model to establish whether it improved the explanation of financial performance. The results are presented in Table 5.

Table 5: Hierarchical Regression Results for Kaizen Costing and Financial Leverage

Variable	Coefficient	Standard Error	P-value
Kaizen Costing	0.42641	0.0083	0.000
Financial Leverage	0.0017	0.1151	0.883
Constant	-0.1045	0.6701	0.119
Model Statistics			
Wald χ^2 (2)	31.31		
Prob > χ^2	0.0000		
R-squared	0.2878		

The results indicated that Kaizen costing had a positive coefficient of 0.42641 and a probability value of 0.000. This showed that Kaizen costing maintained a statistically significant relationship with return on assets after financial leverage was introduced into the model.

Financial leverage recorded a coefficient of 0.0017 and a probability value of 0.883. Since the probability value was greater than the 0.05 significance level, financial leverage did not have a statistically significant direct effect on return on assets in this model.

The overall model was statistically significant, as indicated by Wald χ^2 (2) = 31.31 and p = 0.0000. The R-squared value was 0.2878, indicating that the model accounted for 28.78% of the variation in return on assets.

The model was expressed as follows:

$ROA_{it} = -0.1045 + 0.42641KC_{it} + 0.0017FL_{it} + \varepsilon_{it}$

Step Three: Interaction between Kaizen Costing and Financial Leverage

The third step introduced the interaction term between Kaizen costing and financial leverage to establish the moderating effect of financial leverage. The results are presented in Table 6.

Table 6: Hierarchical Regression Results with the Interaction Term

Variable	Coefficient	Standard Error	P-value
Kaizen Costing	0.0556	0.0095	0.000
Financial Leverage	0.0576	0.0095	0.028
Kaizen Costing × Financial Leverage	-0.0100	0.0260	0.019
Constant	-0.1543	0.0726	0.033
Model Statistics			
Wald χ^2 (3)	34.95		
Prob > χ^2	0.0000		
R-squared	0.3171		

The third step involved the inclusion of the interaction term between Kaizen costing and financial leverage. The results indicated that Kaizen costing

recorded a coefficient of 0.0556 and a probability value of 0.000. This showed that Kaizen costing maintained a positive and statistically significant relationship with return on assets in the interaction model.

Financial leverage recorded a coefficient of 0.0576 and a probability value of 0.028, indicating a positive and statistically significant direct association with return on assets in this model.

The interaction term between Kaizen costing and financial leverage recorded a negative coefficient of -0.0100 and a reported probability value of 0.019. The negative coefficient suggests that the relationship between Kaizen costing and return on assets may weaken as financial leverage increases. The statistical significance of this interaction term, however, depends on verification of the reported standard error and probability value.

The overall model was statistically significant, as indicated by Wald χ^2 (3) = 34.95 and p = 0.0000. The R-squared value of 0.3171 indicated that the model accounted for 31.71% of the variation in return on assets.

The final model was expressed as follows:

$ROA_{it} = -0.1543 + 0.0556KC_{it} + 0.0576FL_{it} - 0.0100(KC_{it} \times FL_{it}) + \varepsilon_{it}$

Discussion

The findings established that Kaizen costing had a positive and statistically significant effect on the financial performance of sugar companies in Kenya. The random-effects regression results yielded a coefficient of 0.0079 (p = 0.028), indicating that improvements in Kaizen costing were associated with increased return on assets. This suggests that continuous improvement, systematic cost reduction and efficient utilisation of production resources can contribute to improved financial performance. The finding is consistent with Tasie et al. (2026), who established that cost-reduction practices significantly influenced financial performance among listed food-products manufacturing companies in Nigeria. Similarly, Elee (2025) found that Kaizen costing significantly influenced return on assets among manufacturing companies in Nigeria. Yiğit (2022) also demonstrated how Kaizen practices facilitate production-cost reduction through continuous improvement. These findings reinforce the importance of systematic cost management in enhancing manufacturing efficiency and financial returns.

However, the finding differs from Jibrin and Maccarthy (2022), who reported an insignificant relationship between Kaizen costing and return on assets, although a significant relationship was established with return on equity. This difference may reflect variations in organisational contexts, implementation practices and financial-performance measures. In Kenya, Colletah et al. (2024) established a significant effect of cost-accounting management practices on the financial performance of public sugar-manufacturing firms. The present study extends their findings by demonstrating the specific contribution of Kaizen costing to return on assets within the sugar-manufacturing sector.

Regarding financial leverage, the findings showed that its direct effect was statistically insignificant in the second hierarchical regression model (p = 0.883). However, in the final interaction model, financial leverage recorded a positive coefficient of 0.0576 (p = 0.028), while the interaction between Kaizen costing and financial leverage was negative and statistically significant (β = -0.0100, p = 0.019). The negative interaction indicates that increasing financial leverage weakens the positive relationship between Kaizen costing and financial

performance. This suggests that although Kaizen costing contributes to improved financial performance, the associated benefits may diminish as debt financing increases, potentially due to interest expenses and other debt-servicing obligations.

The finding is consistent with Wells (2025), who established that financial leverage significantly moderated the relationship between free cash flow efficiency and firm performance among manufacturing companies in Nigeria. Although the direction of the interaction differs, the study supports the argument that financing structure can change the contribution of internal efficiency practices to financial performance. Similarly, Onoja et al. (2026) demonstrated that the moderating influence of leverage varies across organisational relationships, reinforcing the need to examine its interaction with specific operational practices. The negative moderating effect also finds contextual support in Tesema (2024), who established that total and long-term debt negatively influenced return on assets among manufacturing enterprises in Ethiopia. This suggests that increased borrowing costs may constrain the financial benefits generated through operational improvements.

Conclusion

The findings demonstrate that Kaizen costing exerts a positive and statistically significant effect on financial performance. Consequently, Kaizen costing plays a vital role in enhancing the financial outcomes of sugar manufacturing firms in Kenya. Specifically, continuous process optimization, systematic cost reduction, and efficient resource allocation serve as key drivers of profitability. Furthermore, while the hierarchical regression analysis revealed a negative interaction coefficient between Kaizen costing and financial leverage, the corresponding standard error and probability values warrant further empirical confirmation before definitively establishing a moderating effect. The study therefore recognises the importance of examining financial leverage when evaluating the relationship between Kaizen costing and financial performance.

Recommendations

Based on the findings, the study recommends that sugar companies in Kenya should strengthen the application of Kaizen costing in their production processes. Management should promote continuous improvement, employee participation, waste reduction and regular monitoring of production activities to improve operational efficiency and cost management.

Sugar companies should also strengthen the monitoring of production costs and regularly evaluate the efficiency of production processes. Particular attention should be given to the utilisation of raw materials, labour, energy and machinery because these inputs influence production costs and financial performance.

The management of sugar companies should also monitor financial leverage and evaluate the implications of debt financing on their financial performance. Appropriate financial management practices may help companies manage debt obligations while maintaining resources for production improvement and investment in operational efficiency.

Government agencies responsible for the sugar sector, including the Ministry of Agriculture and relevant sugar-sector institutions, should support policies that promote operational efficiency and improved production processes. The government should also

continue addressing structural challenges affecting the sector, including high production costs, inadequate cane supply and processing inefficiencies.

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