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Understanding the Key Determinants of Farmer Loyalty in Sugarcane Farming: Insights from Indonesia

Nugrahini Susantinah Wisnujati[1♥], Hendy Arsyad Rahindra[2], Suwandi S. Sangadji[3], and Paiman[4]

[1]Department of Master in Agribusiness, Faculty of Agriculture, Universitas Wijaya Kusuma, Surabaya, Indonesia
[2]Deputy for Human Resources of Science and Technology, Talent Management Directorate, National Research and Innovation Agency (BRIN), Jakarta, Indonesia
[3]Department of Management, Faculty of Economics and Business, Universitas Airlangga, Surabaya, Indonesia
[4]Department of Agrotechnology, Faculty of Agriculture, Universitas PGRI Yogyakarta, Yogyakarta, Indonesia
♥Corresponding author email: wisnujatinugrahini@uwks.ac.id

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Abstract. Granulated sugar is a vital ingredient in Indonesia, widely used as a sweetener in various food and beverage applications. To meet increasing domestic demand, the government has targeted sugar self-sufficiency by 2025. The Indonesian Long-Term Development Plan 2020–2024 outlines efforts to enhance sugarcane productivity. This study aims to identify the factors influencing farmer loyalty in sugarcane cultivation in Indonesia. A quantitative approach was employed to examine the relationships between government policy, sugar company policy, farmer behavior, and cooperative member participation (independent variables) and farmer loyalty (dependent variable). The data were analyzed using SmartPLS version 4. The results indicate that government policy and cooperative member participation do not significantly affect farmer loyalty, while farmer behavior and sugar company policy have a significant positive influence. Notably, the policies of sugar companies play a pivotal role in shaping farmers' commitment to sugarcane cultivation. These findings suggest that strengthening farmer behavior and enhancing company-level policies can improve loyalty. Furthermore, the results imply that government efforts toward sugar self-sufficiency should not only focus on policy formulation but also ensure alignment with farmers' practical needs and support systems. Integrating sugar company strategies with national agricultural policies could enhance the effectiveness of government programs and accelerate the achievement of self-sufficiency targets.

Keywords: farmer behavior; farmer loyalty; government policy; sugarcane.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) holds significant importance both nutritionally and economically at the global level (Zulu et al., 2019). Its cultivation not only contributes to food production but also serves as a catalyst for socio-economic development. According to Leite et al. (2020), sugarcane cultivation can improve access to infrastructure, employment opportunities, and social services in developing regions. In Indonesia, sugarcane agroindustry has played a crucial and strategic role in national economic development since the Dutch colonial era and continues to be a vital sector (Heryanto and Suryatmana, 2020). The Indonesian government aims to achieve national sugar self-sufficiency by 2025. Achieving this goal requires sustained attention to the agricultural sector's performance, particularly the sugarcane sub-sector, which faces multiple challenges (Gonçalves et al., 2021; Horská et al., 2020; Koo and Taylor, 2015; Solomon and Swapna, 2022; Warsim et al., 2021). Encouraging domestic consumption of local sugarcane products is essential for this transition toward sustainable agriculture.

Indonesia ranks as the ninth-largest sugarcane-producing country in the world, with a production volume of 28.9 million tons in 2020 (FAO, 2020). However, this significant raw output has not translated into sufficient refined sugar production. In 2021, Indonesia's national sugar production reached only 2.35 million tons—far short of its national consumption, which stands at approximately 5.10 million tons annually

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(Ali & Pratiwi, 2022). The production included 1.06 million tons from state-owned sugar mills and 1.29 million tons from privately-owned mills. Notably, smallholder plantations contributed the majority (58.67%) of national sugarcane production, with private estates and state-owned plantations contributing 27.71% and 13.73%, respectively (Mazwan & Masyhuri, 2019). Despite its large production volume, Indonesia remains the world's largest importer of raw centrifugal sugar beet, with total imports reaching 5.26 million tons. The inconsistency between domestic production and demand is exacerbated by structural challenges at the farmer level. One major issue is the insufficient government purchasing price, which often fails to provide a viable profit margin for smallholder sugarcane farmers. Farmers operating on less than one hectare of land often face cash flow constraints that compel them to switch to other, more profitable commodities (Suhesti et al., 2022).

In addition to economic pressures, dissatisfaction among sugarcane farmers stems from opaque practices in partnerships with sugar mills. Issues include unclear pricing structures, distribution rationing, "slashing" orders, and high post-harvest credit costs—all of which contribute to farmers' reluctance to remain loyal to specific buyers or institutions (Istifadhoh et al., 2024; Saufi, 2017). As a result, the relationship between sugarcane farmers and sugar companies—often structured through out-grower schemes—becomes fragile and unstable. These dynamics highlight the political and institutional nature of sugarcane farming in Indonesia (Leite et al., 2020). Given this context, the concept of farmer loyalty emerges as a critical factor in sustaining Indonesia's sugar industry. In this study, farmer loyalty refers to the willingness of farmers to maintain long-term engagement with sugarcane cultivation and to remain committed to their existing partnerships with sugar mills or government programs, despite market alternatives or short-term disadvantages. Loyalty in this context is not merely transactional; it involves trust, perceived fairness, historical relationships, and expectations for future benefits.

While loyalty has been extensively studied in consumer behavior and marketing literature (Sirdeshmukh et al., 2002;Rizki Ramadhan et al., 2024; Pandanwangi et al., 2023), its application in the context of farmer-company relationships—particularly in developing country agricultural systems—is underexplored. For example, in Finland, cooperative loyalty among farmers was influenced by perceptions of fairness, transparency, market access, and long-term mutual experience (Morfi et al., 2015). Similarly, in Indonesia, fostering loyalty among sugarcane farmers could serve as a foundation for more stable supply chains and successful self-sufficiency policies. Farmer loyalty is not shaped solely by economic incentives. Studies show that institutional support—such as access to credit, extension services, market information, and supply chain infrastructure—plays a vital role in sustaining farmers' commitment to a crop or system (Appau et al., 2020; Pivoto et al., 2018). Furthermore, government and private sector initiatives should work in tandem to ensure that sugarcane farmers receive adequate support and feel assured about the future of their agricultural enterprise. Government support has been proven essential in various international cases. In Romania, joint agricultural policies and rural subsidies have been successful in reducing socioeconomic marginalization in rural areas (Galluzzo, 2018). Other policies—such as awareness campaigns about pesticide use (Petrescu-Mag et al., 2019) and climate information services (Okumah et al., 2021)—highlight how tailored government interventions can strengthen farmers' confidence in the system. These examples offer valuable lessons for Indonesia's sugar sector.

Moreover, farmer behavior is also influenced by psychosocial and contextual factors. Socioeconomic status, access to

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knowledge, group norms, and perceived behavioral control all shape farmers' attitudes toward agricultural engagement (Mishra et al., 2018). Unfortunately, these socio-psychological dimensions are often overlooked in policy design. Understanding farmers' personality traits, attitudes, and motivations—as studied in other contexts like the UK and Africa (Antwi-Agyei et al., 2021; Mitheu et al., 2022; Owusu et al., 2020; Zeweld et al., 2017)—can help Indonesian sugar companies and policymakers develop more nuanced strategies. An essential component of loyalty is communication and trust. Regan and Kenny (2022) emphasize the importance of dialogue-based communication for fostering responsive and participatory behavior among farmers. Enhanced participation can improve not only policy implementation but also farmer satisfaction and loyalty. As Floress et al (2018) argue, data on farmer behavior are crucial for crafting effective interventions. Differences in farmer perceptions of public and private service quality (Kassem et al., 2020) also point to the need for responsive and customized institutional services.

In agricultural export systems—such as Rwanda's coffee value chain—lack of farmer participation in governance has led to lower farm-level prices and reduced motivation to invest in the sector (Rigg et al., 2018). A similar risk exists in Indonesia's sugarcane industry, where fragmented institutional relationships and limited transparency may undermine farmer commitment. Building farmer loyalty, therefore, requires not only economic incentives but also inclusive governance and transparent partnerships. Research on farmer loyalty in the context of sugarcane remains limited. While studies have analyzed farmer behavior in other crops such as rice and tobacco, there is a gap in the literature regarding the behavioral and institutional factors that influence loyalty in sugarcane cultivation. To address this gap, this study seeks to examine the key determinants that influence farmer loyalty in the Indonesian sugar industry. Specifically, this study investigates the behavioral, institutional, and economic variables that contribute to farmers' decisions to remain committed to sugarcane cultivation and to their relationships with sugar companies or cooperatives. In doing so, this research provides critical insights into how Indonesia can achieve its sugar self-sufficiency goals through more stable and mutually beneficial farmer-industry relationships.

METHODS

Research design

This study employed a quantitative research design to examine the influence of government policy (X1), sugar company policy (X2), farmer behavior (X3), participation of cooperative members (X4), and farmer loyalty (Y). Data were collected using a structured, closed-ended questionnaire based on a five-point Likert scale. The questionnaire items were developed to reflect indicators associated with each variable under investigation.

Specifically, government policy, sugar company policy, farmer behavior, participation of cooperative members, and farmer loyalty were measured using 10, 7, 7, 5, and 5 indicators, respectively. The selection of these indicators was grounded in relevant theoretical models. Respondents' answers were analyzed quantitatively to assess the relationships among the variables. The operationalization of variables, including their indicators and measurement scales, is presented in Table 1.

Research Setting

This research was conducted in Kembangbahu District, Lamongan Regency, East Java, Indonesia. The location was purposively selected due to its strategic role in sugarcane production and the completeness of institutional support in the area. Kembangbahu hosts active sugarcane farmers, sugar companies, smallholder farmer cooperatives, and relevant government agencies. These components provided a conducive environment for collecting comprehensive and relevant data

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concerning sugarcane cultivation practices, policy implementation, and farmer behavior.

Table 1. Research variables and indicator

Variables	Code	Indicators
Government policy (X1)	X 1.1	Create conditions for the development of competitive companies
	X 1.2	Supporting regulations and laws
	X 1.3	Improvement and development of the people's sugarcane infrastructure
	X 1. 4	Protection of farmer from exploitation
	X 1. 5	Integrated information system
	X 1. 6	Promotion with stakeholders
	X 1.7	Investment credit support and interest subsidy
	X 1. 8	Become a motivator
	X 1.9	Become stabilizer
	X 1.10	Equitable distribution of justice
Sugar company policy (X2)	X 2.1	Equitable distribution of justice
	X 2.2	Provide guidance and conseling
	X 2.3	Drawing up a business plan
	X 2.4	Capital credit guarantor
	X 2.5	Technology guidance
	X 2.6	Provision of Production Facilities
	X 2.7	Guaranteed purchase of sugarcane production people
Farmer Behavior (X3)	X 3.1	Mastery of technology (varieties and cultivation
	X 3.2	Assurance of quality, quantity, and continuity
	X 3.3	Attitude towards type/variety suitability
	X 3.4	Mastery of technology (Varieties and cultivation
	X 3.5	Assurance of quality, quantity and continuity
	X 3.6	Risk sharing
	X 3.7	Equalization of welfare
Participation of cooperative members (X4)	X 4.1	Join a meeting
	X 4.2	Making decisions
	X 4.3	Voting
	X 4.4	Direct Involvement in activities
	X 4.5	Evaluation engagement
Farmer loyalty (Y)	Y1	Land suitability
	Y2	Land tenure
	Y3	Partnership with sugarcane factory age farmer sugarcane
	Y4	Cultivation income sugarcane
	Y5	Farmer

Population and Sampling Technique

The target population of this study comprised sugarcane farmers who are members of smallholder cooperatives in Kembangbahu District. Based on cooperative records and agricultural office data, the total number of active cooperative-affiliated sugarcane farmers in the district exceeds 400 individuals. A purposive sampling technique was employed to select the respondents, based on the following inclusion criteria: (1) being an active member of a farmer

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cooperative, (2) having been involved in sugarcane farming for at least the past three consecutive years, and (3) directly engaging with sugar companies in production or marketing processes. A total of 120 farmers were selected as respondents. The sample size was determined with reference to the Partial Least Squares Structural Equation Modeling (PLS-SEM) method, which recommends a minimum of 3–5 respondents per measurement indicator (Hair et al., 2017). Given the 34 indicators used in this study, the recommended sample size ranges from 102 to 170. Therefore, the 120 respondents selected are statistically adequate. Furthermore, the sample also satisfies the "10-times rule," which requires at least ten times the number of maximum structural paths directed at any single latent construct in the model.

Data Collection Techniques

Primary data were gathered through structured face-to-face interviews conducted over a four-month period, from June to September 2022. A standardized questionnaire was utilized to collect information on several constructs, including government policy, sugar company policy, cooperative participation, farmer behavior, and farmer loyalty. Each construct was measured using multiple indicators based on a five-point Likert scale.

Data Processing and Analysis

Data processing involved both numerical and non-numeric methods. The data analysis techniques used to gradually improve loyalty by increasing awareness among sugarcane farmers. Relationship analysis was conducted using Smart PLS software version 4 to analyze the causal relationship models between variables.

Descriptive Analysis

People's Sugarcane Awareness (Loyalty)

The level of loyalty of the people's sugarcane business was identified from the level of loyalty of farmers by using the scoring method (Likert scale). The level of loyalty of sugarcane farmers was calculated based on the number of scores from questionnaire answers number 1 to 5. The answer choices in the questionnaire were letters a, b, c, d, or e with answer scores a (score 1), b (score 2), c (score 3), d (score 4), and e (score 5). The higher the number of scores obtained by respondents, the higher the respondent's tendency to loyalty. The maximum score value of each question was 5 and the number of questions was 5 items. The qualitative was very low to very high (5 criteria used), then the maximum score value of 25 obtained from the questionnaire answers used is divided into 5 categories in question so that the score categories can be described as follows: (1). Score 0 – 5 = very low, 2). Score 5.1 – 10 = low, 3). Score 10.1 – 15 = high enough, 4). Scores 15.1 –20 = high, and 5). Score 20.1 – 25 = very high.

Observation variables

This study had five variables: farmer loyalty, government policies, the role of farmer behavior, participation, and sugarcane company policies. The relationship between these variables was analyzed by forming a path diagram causality relationship. Based on the theory obtained in this study, the conceptual path diagram of the causality relationship between variables and indicators can be seen in the flowchart in Figure 1.

Identification of variables in the analysis of the relationship between variables of farmer behavior, government policies, participation, sugar company policies and loyalty of small sugarcane farmers in their sustainability to cultivate people's sugarcane consisted of exogenous variables including government policies, sugarcane company policies, farmer behavior, and participation. Government policy is one form of government intervention to maintain the loyalty of sugarcane farmers. Government policy is measured by observing farmers' opinions of the government. The government needs to develop competitive enterprises, support regulations and laws; improve infrastructure and development, protect farmers from exploitation; integrate information systems; jointly promote stakeholders; invest in credit support and

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interest subsidies; be a motivator, stabilizer, and ensure fair distribution.

Sugar company policy was all activities to maintain farmer loyalty, either directly through mediating farmer behavior by looking at indicators of providing guidance and counseling function; drawing up a business plan; capital credit guarantor; technological guidance; provision of production facilities; guarantee of the purchase of people's sugarcane production; promotion of production results, as well as technological development.

The role of ethnicity in various aspects of farmers' attitudes and behavioral activities could support the realization of sugarcane cultivation loyalty which could be seen through knowledge of land suitability, attitude to the suitability of the breed or variety; mastery of technology (variety and cultivation); assurance of quality, quantity, and continuity; risk sharing; equitable distribution of welfare; post-harvest management; facilities and infrastructure; land ownership; access capital; level of education, and mental attitude of farmers.

Farmer loyalty

Farmer loyalty is essential for ensuring the long-term sustainability of their business. The key factors for determining farmer loyalty include land suitability, land ownership, partnership patterns with sugarcane companies, cultivation management age, and sugarcane cultivation income. Field observation data was collected from 110 respondents using the Likert scale. Option A scored 1, indicating a significantly low role contribution. On the other hand, Option E has a score of 5, representing a significantly greater role contribution, which is the maximum score. A total of 35 questions were used to assess the influence of government policy, sugar company policy, farmer behavior, and farmer loyalty. Validity and reliability tests were conducted after data were collected.

RESULTS AND DISCUSSION

Prior to testing the structural model, the measurement model was first evaluated to ensure the reliability and validity of the constructs used in the study. This assessment included indicator reliability, internal consistency reliability, convergent validity, and discriminant validity using outputs from SmartPLS 4.0. The loading factor analysis was applied to determine how well each indicator measured its latent construct, where values above 0.70 indicate satisfactory reliability (Hair et al., 2019). The findings revealed that all indicators for government policy (X1), company policy (X2), cooperative participation (X3), farmer behavior (X4), and farmer loyalty (Y) had loading factor values exceeding 0.70. These results confirm that each indicator strongly represents its respective latent variable, ensuring accurate construct measurement. Discriminant validity was further examined using the Fornell-Larcker criterion and cross-loading method as recommended by Sekaran and Bougie, (2011). The results indicated that the square root of the Average Variance Extracted (AVE) for each construct was greater than its correlations with other variables, confirming empirical distinctness. In addition, the cross-loading analysis showed that each indicator loaded highest on its intended construct, and the Heterotrait-Monotrait (HTMT) ratios were all below 0.90, demonstrating the absence of multicollinearity and supporting the discriminant validity of the model (Hair et al., 2019).

Regarding convergent validity, all constructs exhibited AVE values greater than 0.50, meeting the minimum acceptable threshold. The farmer behavior construct, in particular, achieved an AVE of 0.76, indicating that over 76% of the variance in its observed indicators was explained by the latent construct. This high AVE value reflects that the indicators effectively represent the underlying behavioral construct. Moreover, the composite

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reliability (CR) values for all constructs exceeded 0.70, with the farmer behavior construct reaching a CR of 0.957, demonstrating strong internal consistency among its measurement items. These findings suggest that all constructs—farmer behavior, farmer loyalty, company policy, government policy, and cooperative participation—are both reliable and valid in capturing their respective latent variables, thus establishing a solid foundation for subsequent structural model analysis.

Structural Model Evaluation

The results of the evaluation of the multicollinearity value between the latent variable (VIF in) < 5 and the statistical t (significance of the coefficient path) > 1.96 or the p-value < 0.05 is shown in Figure 1.

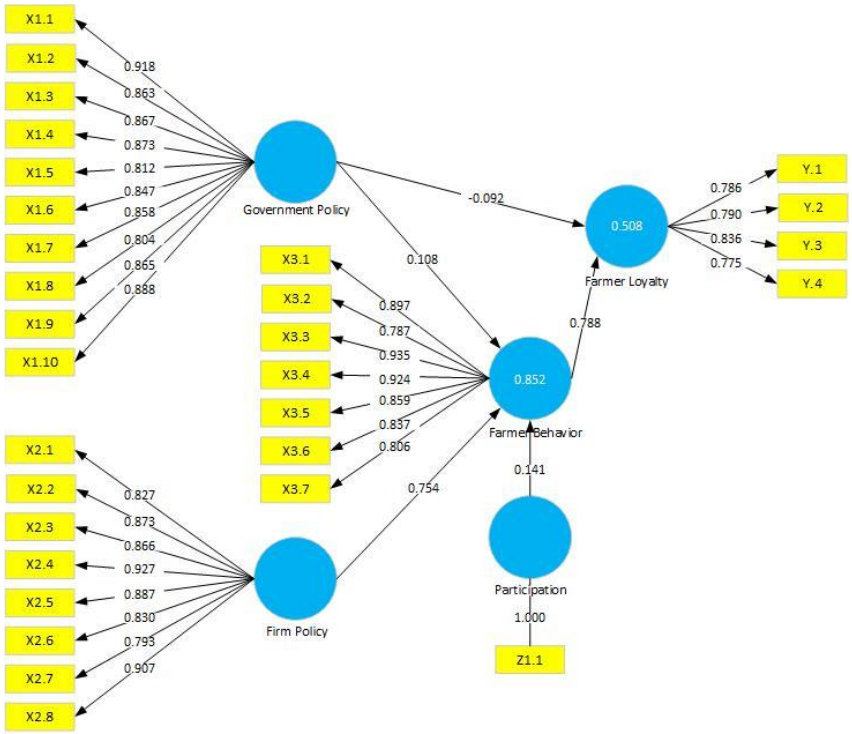

Figure 1. Path diagram of causality relationship between variables and indicators

The structural model results reveal that company policy has the strongest and most significant effect on farmer behavior (β = 0.862, p < 0.001), indicating that transparent pricing, guaranteed purchase agreements, and production incentives have a substantial influence on farmers' engagement in sugarcane cultivation. This finding supports Agency Theory and the Resource-Based View (Barney, 1991), emphasizing that institutional support and market structures shape individual economic behavior, consistent with Ibrahim & Workneh, (2019), who found that agribusiness policies and technical support drive farmers' adoption of better practices. Company policy also significantly enhances farmer loyalty (β = 0.60, p = 0.034), while farmer loyalty itself positively affects farmer behavior (β = 0.49, p = 0.014), showing that loyal farmers tend to act more productively and consistently. In contrast, government policy influences farmer loyalty (β = 0.364, p = 0.024) but not behavior directly (p = 0.509), and cooperative participation has no significant effect (p = 0.974). Overall, company policy and farmer loyalty emerge as the key determinants shaping sugarcane farmers' behavioral outcomes.

Furthermore, farmer behavior was found to have a significant impact on farmer loyalty, with a coefficient of 0.49 (p = 0.014). This

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indicates that the more active, responsive, and innovative farmers are in managing their sugarcane farms, the more likely they are to remain loyal to sugarcane cultivation and maintain partnerships with sugar companies. This finding supports the Theory of Planned Behavior (Ajzen, 1991), which suggests that actual behavior is a primary predictor of long-term intention and individual commitment. A previous study by Sunandar et al. (2021) also emphasized that farmers' knowledge, attitudes, and proactive behavior are strongly correlated with their loyalty to a particular agricultural system. In addition, company policy also directly influences farmer loyalty, with a coefficient of 0.60 and a p-value of 0.034, indicating statistical significance. This finding reinforces the view that companies not only shape farmer behavior but also play a crucial role in building farmers' emotional and economic attachment to the sugarcane agribusiness system. Fair, sustainable, and participatory policies encourage farmers to remain committed to sugarcane production. This is in line with the study by Zárate et al. (2021), which found that long-term relationships between companies and farmers are influenced by farmers' perceptions of the value and fairness of company policies.

Interestingly, government policy yielded mixed results. On the one hand, its effect on farmer behavior was not statistically significant (coefficient = 0.059; p = 0.509), indicating that government interventions such as subsidies, training programs, or technical support have not been effective in directly changing farmers' behavior. This may be due to inconsistent policy implementation at the field level or a mismatch between government interventions and farmers' actual needs. On the other hand, government policy significantly influenced farmer loyalty (coefficient = 0.364; p = 0.024), suggesting that while it may not change behavior, it can shape long-term positive perceptions of the sugarcane sector. This indicates a symbolic or institutional effect, where the presence of the state is perceived as a guarantee of agricultural sector stability, as described in the theory of Institutional Trust (Ostrom, 1990). The study by Kodithuwakku & Weerakoon (2020) also showed that farmers' perceptions of long-term governmental commitment can influence their willingness to remain in a particular agricultural sector. Finally, participation in cooperatives did not show a significant effect on farmer behavior (coefficient = 0.002; p = 0.974), suggesting that formal membership in cooperatives does not necessarily lead to active farmer engagement in technology adoption or cultivation practices. This may be due to the weak role of cooperatives in providing added value or relevant services, rendering their presence insufficient to shape farmer behavior in a meaningful way. This finding is consistent with research by Charinda (2015), which highlights that the effectiveness of cooperatives depends heavily on managerial capacity, institutional support, and the relevance of programs to members' needs.

Table 2. The coefficient interval at 95% confidence value

Direct effect	Original sample (O)	Sample mean (M)	2.50%	97.50%
Farmer loyalty → Farmer behavior	0.49	0.495	0.13	0.912
Firm policy → Farmer behavior	0.862	0.854	0.660	1.020
Firm policy → Farmer loyalty	0.600	0.600	-0.025	1.104
Government policy → Farmer behavior	0.059	0.066	-0.106	0.245
Government policy → Farmer loyalty	-0.364	-0.365	-0.672	-0.037
Participation → Farmer behavior	-0.002	-0.006	-0.103	0.086

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Table 2 shows the influence of farmer behavior on farmer loyalty ranges from 0.13 to 0.912. Sugarcane farmer behavior increased by 0.912 as farmer loyalty grew with different activities. Farmers' behaviors will have an impact on their willingness to plant sugarcane. Farmer behavior influenced sugar business policies toward farmer loyalty to sugarcane planters. Meanwhile, there could be no mediation for the participation of sugarcane farmers and government policy to cultivate sugarcane for the people permanently. Government policy cannot force farmers to cultivate sugarcane but must mediate farmer loyalty. As a result, the government must be able to gain farmers' loyalty so that they will cultivate sugarcane. However, sugar company policy could directly affect the farmers who grow sugarcane (Table 3).

Table 3. Mediation test

Indirect effect	Original sample (O)	Sample mean (M)	(STDEV)	T statistics (O/STDEV|)
Firm policy → Farmer behavior → Farmer loyalty	0.422	0.434	0.204	2.075
Participation → Farmer behavior → Farmer loyalty	-0.001	0.001	0.025	0.030
Government policy → Farmer Behavior → Farmer loyalty	0.029	0.023	0.043	0.681

The results of the mediation analysis presented in Table 3 provide further insights into the indirect pathways through which key variables affect farmer loyalty, with farmer behavior acting as the mediating variable. Among the three mediation pathways tested, only the indirect effect of firm policy on farmer loyalty through farmer behavior was found to be statistically significant (coefficient = 0.422; t = 2.075). This indicates that the influence of sugar company policy on farmer loyalty is not merely direct but is substantially mediated by changes in farmer behavior. In other words, effective corporate policies—such as price guarantees, access to inputs, and fair contractual agreements—can foster behavioral changes among farmers (e.g., adopting improved cultivation practices or aligning with company production standards), which in turn enhance their loyalty to the sugarcane sector. This result is theoretically supported by the Theory of Planned Behavior (Ajzen, 1991), which posits that behavioral intention and loyalty are determined not only by external stimuli but also by the internalized attitudes and behaviors that develop in response to those stimuli. In this context, the policies of sugar companies act as an enabling environment, while behavior reflects farmers' willingness to respond to such policies. Empirical evidence from Sunandar et al. (2021) also underscores the importance of farmer knowledge and behavioral adaptation in mediating long-term engagement with agricultural systems. When farmers understand and internalize the benefits of company policies, their behavioral change leads to stronger emotional and economic attachment to the company's production system.

Conversely, the mediation paths involving cooperative participation and government policy through farmer behavior did not yield statistically significant effects ($p > 0.05$, with $t = 0.030$ and $t = 0.681$, respectively). The extremely low mediation effect from cooperative participation (coefficient = -0.001) suggests that formal involvement in cooperatives does not meaningfully alter farmer behavior in ways that would translate into increased loyalty. This finding may reflect the limited role that cooperatives currently play in facilitating behavioral change, possibly due to inadequate service delivery, weak institutional capacity, or a lack of tailored programs aligned with farmers' needs

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(Charinda, 2015). Similarly, although government policy showed a significant direct effect on loyalty (as discussed in the previous section), its indirect effect through farmer behavior is insignificant (coefficient = 0.029; t = 0.681). This implies that current government interventions—such as subsidies, technical assistance, or extension services—are not effectively translating into behavioral changes among farmers. The absence of behavioral mediation suggests a gap between policy design and field-level implementation. This aligns with the critique from Kodithuwakku & Weerakoon (2020), who argue that the success of agricultural policy depends not only on its existence but also on its adaptability, accessibility, and relevance to local farming realities.

The significant mediation role of farmer behavior in the firm policy-loyalty relationship highlights several practical implications. First, companies should not only offer attractive policies but also actively engage in capacity-building initiatives that promote behavioral adaptation, such as farmer field schools, continuous training, and participatory decision-making processes. Second, improving farmers' access to information, education, and market literacy becomes crucial in enhancing the behavioral responsiveness needed to build long-term loyalty. As noted by Kassem et al. (2020), behavioral reinforcement through education, motivation, and empowerment contributes to the sustainability of farmer engagement. Furthermore, studies on work ethics in agriculture (Clay et al., 2018; Engström and Hajdu, 2019) affirm that cultivating a strong work ethic among farmers—characterized by responsibility, discipline, and perseverance—can improve both productivity and loyalty. Such behavioral foundations are essential for fostering long-term collaboration between farmers and institutional stakeholders (Wisnujati et al., 2025). Enhancing service quality, ensuring farmer satisfaction, and encouraging two-way communication between farmers and sugar companies are also strategic measures to support this behavioral transformation. There was a fit test model that if R square is 0.02 = low, 0.15 = medium, and 0.35 = high. Farmer behavior influenced the low structural rate of 0.09. The sugar company policy had a high structural effect on farmer loyalty.

The combined influence of government policies, company policies, and farmer participation on farmer loyalty accounted for 84% of the variance, as indicated by the R-squared value. This demonstrates a strong explanatory power of the model. Furthermore, the model's goodness-of-fit is supported by the Standardized Root Mean Square Residual (SRMR) value, which remains within acceptable limits. According to Schermelleh-Engel et al. (2003), an SRMR value below 0.10 is considered acceptable for model fit. Detailed values for both R-squared and SRMR are presented in Table 4 for reference and further interpretation.

Table 4. Value of R square and SRMR

Value of R square		
	R-square	R-square adjusted
Farmer behavior	0.840	0.836
Farmer loyalty	0.575	0.564
Value of SRMR		
	Saturated model	Estimated model
SRMR	0.081	0.081
d_ULS	6.485	6.514
d_G	269.503	269.823
Chi-square	614.954	614.954
NFI	0.600	0.600

The results presented in Table 4 provide a comprehensive overview of the model's explanatory power and overall fit, measured through R-square (R^2) values and the Standardized Root Mean Square Residual (SRMR). The R^2 value for farmer behavior was 0.840, indicating that 84% of the variance in farmer behavior is explained by the combination of government policy, sugar

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company policy, and cooperative participation. This high value suggests a strong explanatory capacity of the model regarding the behavioral patterns of sugarcane farmers. It also reflects the extent to which external institutional factors, particularly corporate and government interventions, influence individual-level behavioral change. Theoretically, this finding aligns with the Institutional Theory (Scott, 2017), which posits that individual actions are shaped by formal structures, rules, and norms imposed by surrounding institutions. In the context of this study, government support mechanisms—such as input subsidies, access to credit, and agricultural extension services—play a crucial role in encouraging farmers to adopt improved practices (Huang et al., 2023; Kodithuwakku & Weerakoon, 2020; Zantsi, 2021). Although previous direct path analysis (Table 3) showed that government policy did not significantly affect farmer behavior in isolation, the high R^2 suggests that when combined with corporate policies and cooperative participation, government interventions still contribute meaningfully to behavioral outcomes.

In parallel, the R^2 value for farmer loyalty was 0.575, indicating that 57.5% of the variance in loyalty can be explained by the variables included in the model, particularly farmer behavior and sugar company policy. This represents a moderate level of explanatory power (Hair et al., 2019), implying that while the model captures more than half of the factors influencing loyalty, other latent or unobserved variables—such as price volatility, market risks, or cultural attitudes—may also play a role. The adjusted R^2 values (0.836 for behavior and 0.564 for loyalty) confirm the model's robustness after accounting for complexity and number of predictors. In terms of model fit, the SRMR value was 0.081, which is below the threshold of 0.10 as suggested by Henseler et al. (2016), indicating that the model exhibits an acceptable level of fit between the predicted and actual correlation matrices. The Saturated Model and Estimated Model both reported identical SRMR values, reinforcing internal consistency. Other fit indices, such as Chi-square = 614.954, d_ULS = 6.485, and Normed Fit Index (NFI) = 0.600, while not optimal, are still within the tolerable range for complex structural models using partial least squares (PLS-SEM).

Moreover, the inclusion of cooperative participation as a predictor variable contributes to understanding farmer behavior, especially through its role in facilitating training, peer learning, and access to production resources. Though its direct effect was found to be insignificant, its presence in the model enriches the institutional context by representing collective action and grassroots engagement (Charinda, 2015). Meanwhile, the firm policy variable—which includes mechanisms like guaranteed crop procurement, pricing transparency, and input support—emerged as a consistently strong predictor across all tested outcomes, as shown in both direct and mediated path analyses (Table 3). These findings offer meaningful implications. First, the high R^2 value for behavior highlights the critical role of multi-stakeholder alignment—particularly the synergy between government, cooperatives, and companies—in shaping farmers' day-to-day actions. Second, the moderate R^2 value for loyalty suggests that interventions aimed at improving loyalty should extend beyond transactional incentives and incorporate affective, relational, and psychological dimensions—such as trust, fairness, and long-term partnership (Ibrahim & Workneh, 2019; Zárate et al., 2021).

CONCLUSION

This study concludes that government policy and cooperative member participation do not have a significant impact on farmers' loyalty in sugarcane cultivation in Indonesia. Conversely, farmer behavior and sugar company policies show a significant positive influence. These findings highlight the central role of individual behavioral factors

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and institutional support—particularly from sugar companies—in shaping farmers' continued commitment to sugarcane farming. Improving farmer behavior through training, extension services, and knowledge-sharing initiatives can enhance productivity and strengthen loyalty. Most notably, sugar company policies—such as fair pricing, timely payment, guaranteed market access, and support services—are found to be key drivers of farmer loyalty. Therefore, sugar companies should establish and consistently communicate clear, transparent, and inclusive policies tailored to the practical needs of farmers. From a policy standpoint, these findings suggest that government efforts toward achieving sugar self-sufficiency must be aligned with private sector strategies. A more integrated approach involving coordination between public agricultural programs and sugar company operations is needed to foster a sustainable and loyal farming community. For future research, it is recommended to explore the long-term effects of sugar company policies on farmer loyalty, including how consistent policy implementation over time influences retention, productivity, and intergenerational continuity in farming. Longitudinal studies or mixed-methods approaches could provide deeper insights into these dynamics and guide more effective policy interventions.

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