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Analysis of the Factors Affecting Sugarcane Production and Farmers' Planting Intentions in Davao del Sur, Sarangani and South Cotabato

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Abstract. The study aimed to analyze the factors affecting sugarcane production, including economic, agricultural, environmental, social, technological, political, institutional, and infrastructure factors, as well as their possible influence on sugarcane farmers' planting intentions in Davao del Sur, Sarangani, and South Cotabato. As the global trend in sugarcane production declines, it is crucial to understand the factors that influence farmers' decisions to plant sugarcane. However, farming decisions are heavily influenced by multi-dimensional aspects that somehow impact the sustainability of the sugarcane industry. The study employed a descriptive-quantitative survey research design, administered to 89 selected medium- to large-scale sugarcane farmers using a sampling technique. Statistical tools include descriptive statistics (frequency distribution and mean), Pearson r, and Multiple Regression Analysis. The results showed that the sector was primarily composed of aging farmers with limited formal education, which may hinder the adoption of modern farming techniques. Farm-related issues, such as hilly or rolling terrains and dependence on rainwater, heightened vulnerability to climate variability. Economic and social factors underscore the significant influence farmers have on sugarcane production. Consistently, correlational analysis showed that economic factors had the strongest and appeared most significant to farmers' planting intentions, reflected by an r-value of 0.678 and a p-value of <0.001. Multiple regression confirmed that economic factors were the sole predictor ($p < 0.001$), with the highest standardized coefficient (0.530), influencing farmers' planting intentions. Based on the findings, the Department of Agriculture and State Universities and Colleges should launch youth-targeted agricultural programs on modern sugarcane farming techniques. Government agencies should introduce mechanization suited for hilly and rolling terrains, including irrigation projects, to reduce reliance on rainwater and provide production support programs and policy efforts that strengthen market prices, minimize costs, and ensure access to affordable credit for the sustainability of sugarcane farming.

Keywords: Economic factors; Planting intentions; Sugarcane; Sugarcane production; Sustainability.

1.0 Introduction

Saccharum officinarum, commonly referred to as sugarcane, is a perennial grass that is grown mainly for the juice, which is turned into sugar. This crop is cultivated in over 100 countries by independent farmers and agro-

industrial companies. The majority of sugarcane planted worldwide is grown in tropical and subtropical climates. Since the plant can be used to create ethyl alcohol directly, it is also planted for biofuel. Straw and bagasse (cane fibers), molasses, and rum are some of its byproducts (OECD-FAO, 2019).

Sugarcane ranks among the world's most extensively cultivated crops, serving as a cornerstone of the global economy. In the Philippines, it stands as a pillar of agricultural development, driving rural economies and sustaining the livelihoods of millions. Different regions exemplify this significance, with sugarcane farming deeply woven into the socio-economic fabric of their communities. However, farmers face mounting challenges that directly shape planting intentions and threaten the sustainability of the industry.

In Mexico, numerous obstacles face the sugar industry, including high crushing capacities, adverse environmental effects, and limited capacity to supply sugarcane from fields. The Mexican yield decline is defined as "the loss of productive capacity of sugarcane growing soils under long-term monoculture" due to the loss of soil nutrients, heightened susceptibility to diseases and pests, and deteriorating environmental conditions. Continuous farming resulted in decreased soil fertility, which affects the production and viability of its economy (Rodriguez et al., 2012). Seemingly, Chohan (2019) concluded that yield production per hectare, which ranges from 56 to 86 tons per hectare, is far less than the possible potential of about 100 to 130 tons. The researcher attributed the event to the changing environment as one of the primary causes of reduced yield. Moreover, since expanding sugarcane acreage is extremely difficult, attempts are made to increase yield production within the same farmed area. To make it possible, the use of current technologies that are appropriate for the changing environment must be adapted.

The Philippines, being an archipelago, is among the nations that are most susceptible to impending climate change and natural calamities worldwide (Oñal et al., 2022). Sugarcane is a crop that was immediately destroyed by natural disasters that struck this area. In an attempt to find possible means to boost agricultural output and sugarcane yield, the Sugarcane Regulatory Administration began using Sugarcane Block Farming in 2012. However, there have been few empirical studies on economic performance since its introduction years ago (Matsuura, 2020).

According to Shen et al. (2023), the basis of any country's economy is its farming sector. Moreover, the involvement of pertinent stakeholders is essential to its development. Since farmers are the primary decision-makers and contributors to agricultural production, issues that influence their willingness to participate must be taken into consideration. Understanding how individuals formulate intentions, such as farmers' plans to plant, will contribute significantly to increasing yield, as it will offer helpful information for improved resource management and planning. Results from Lavanya and Manjunatha's (2019) research showed that one of the most fundamental tasks in the field of agricultural economics is probably determining how individual agricultural sectors make decisions. Additionally, it will facilitate early intervention through targeted assistance and policy initiatives. Lastly, this knowledge will facilitate supply chain optimization, ensuring a smooth production flow from farm to market and enabling more effective plans for harvesting and processing.

Farmers' planting intentions in Pakistan were used to restore degraded forest areas and ensure the sustainable use of marginal lands. It was indeed seen as the most practical and workable solution in the current conditions of the country (Khan et al., 2024). The study results provided the basis for proposing a solution for the future to strengthen tree-planting decisions, promote household engagement, and attract farmers to plantation activities in the area.

Here in the Philippines, specifically in Davao del Sur, Sarangani, and South Cotabato, sugarcane farmers face numerous factors that impact production, including economic, environmental, agricultural, social, technological, political, institutional, and infrastructural conditions. Understanding these dynamics is key to shaping farmers' planting intentions, the dependent variable in this study. By analyzing the independent variables mentioned above, this research aims to uncover patterns that influence planting intentions. Specifically, it aims to identify the variables that most strongly correlate with planting decisions and develop practical recommendations to promote economic prosperity and sustainability in the sugarcane industry.

2.0 Methodology

2.1 Research Design

The study employed a descriptive correlation research design, a quantitative research method that involves two or more quantitative variables from the same group of participants. A quantitative method emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data. Its purpose is to examine the relationship between variables, the independent and the dependent variables.

2.2 Participants and Sampling Technique

The respondents in this research were 89 medium- and large-scale sugarcane farmers from Davao del Sur, Sarangani, and South Cotabato. All participants were duly registered and had milling contracts with the sole milling company in Davao del Sur. These farmers are verified active for the crop year 2022-2023, regardless of whether they have actual sugarcane deliveries during the season. Their inclusion in the study ensures a focus on formally engaged and recognized producers within the sugarcane industry. This targeted selection enhances the reliability of the data, as the respondents are involved in regulated farming practices. Moreover, the geographic coverage of three key sugarcane-producing provinces provides a broader perspective on regional production trends and farmer behavior.

The researcher employed a Purposive Sampling Technique, also known as selective sampling, a non-probability sampling method in which the researcher purposefully selects individuals or groups based on particular traits or standards most relevant to the study's objectives. Respondents were subject to the following conditions:

a. With a valid contract agreement within the crop year 2022-2023;
b. with or without sugarcane deliveries to the mill site on the same crop year; and
c. The farm is located in Davao del Sur, Sarangani, and South Cotabato.

Small-scale farmers, defined as those managing 10 hectares or fewer, were not included in the study. Excluding these farmers enhances internal validity by ensuring the sample is more homogeneous in terms of resource endowment, risk-bearing capacity, and institutional integration. However, this choice does limit the generalizability of the findings, as the results may not fully translate to smallholder contexts, where decision processes and constraints differ significantly. Additionally, farmers with expired contracts, even those categorized as medium-scale or large-scale, were excluded. Participants who voluntarily withdrew their consent to participate at any point during the study were also removed from the research. This approach ensured that only active, willing, and relevant participants were involved, maintaining both the accuracy and ethical integrity of the study.

2.3 Research Instrument

This research utilized a researcher-made questionnaire, an original tool created by the researcher to collect data that aligns with the research goals and areas of interest. The questionnaire was carefully designed to ensure it captures the relevant variables and provides transparent, reliable, and valid responses from participants. Before the questionnaire was used for data collection, it underwent a rigorous process to ensure validity and reliability. Initially, the questionnaire underwent a content validity assessment by a panel of experts in the relevant field. Their feedback was used to refine the items for clarity, relevance, and comprehensiveness. Following this, a pilot testing procedure was conducted to sample participants from a group that was representative of the target population but not included in the final study. The responses were analyzed to identify any ambiguous, confusing, or biased questions. Additionally, the reliability of the instrument was assessed using Cronbach's alpha, a statistical method that measures internal consistency.

2.4 Data Gathering Procedure

The researcher began each 30-minute face-to-face survey by securing permission and briefly explaining the study's purpose and the vital data to be collected from selected sugarcane farmers. Using purposive sampling based on predefined criteria, the researcher then introduced the questionnaire, distributed it to medium- to large-scale farmers, and collected the completed forms, ensuring utmost confidentiality. Once gathered, the responses were tallied, after which the data were carefully computed, analyzed, and interpreted. To enrich the findings, a review of related literature was subsequently conducted to support the results.

2.5 Data Analysis

The statistical data were analyzed in IBM SPSS Statistics and interpreted based on a 0.05 level of significance using the following statistical tools:

Frequency and Percentage Distribution
These were used to summarize and describe the socio-demographic profile and farm profiles of the farmer-respondents.

Standard Deviation and Mean
This was used to calculate the average values of the primary data related to both independent variables, factors affecting sugarcane production, and the dependent variable, farmers' planting intentions.

Pearson r
This was used to determine the relationship between the independent variables, factors affecting sugarcane production, and the dependent variable, farmers' planting intentions.

Multiple Regression Analysis. This was used to determine which of the independent variables significantly predicts the planting intentions of medium- to large-scale farmers. Regression assumption testing was conducted by verifying linearity, checking normality, assessing the independence of errors, and identifying outliers and influential cases, all of which were done before interpreting the final model.

3.0 Results and Discussion

3.1 Socio-Demographic Profile of the Respondents

It has been found that a significant majority (61.80%) of sugarcane farmers are aged 50 and above, indicating an aging workforce in the industry. This aligns with Manigo (2021), who identified aging as a persistent trend among Filipino farmers, particularly in traditional crop sectors such as rice and sugarcane.

Table 1. *Frequency and Percentage Distribution of Respondents*

Indicators	Frequency	Rf (%)
Age		
Below 30	2	2.20
30-39	7	7.90
40-49	25	28.10
50 and above	55	61.80
Total	**89**	**100.0**
Gender		
Male	44	49.44
Female	44	49.44
Prefer not to Say	1	1.12
Total	**89**	**100.00**
Educational Attainment		
Elementary Graduate	1	1.10
High School Level	4	4.50
High School Graduate	39	43.80
College Level	24	27.00
College Graduate	16	18.00
Post Graduate	4	4.50
Others, Vocational	1	1.10
Total	**89**	**100.00**
Farm Experience		
Below 5 years	3	3.40
5-10 years	8	9.00
11-15 years	8	9.00
16-20 years	17	19.10
21-25 years	31	34.80
More than 25 years	22	24.70
Total	**89**	**100.00**
Tenure		
Owner	59	66.30
Lessee	21	23.60
Administrator	2	2.20
Others, Mixed Status	7	7.90

Total	**89**	**100.00**

Male and female participation in sugarcane farming was evenly distributed, with both sexes accounting for 49.44%. This suggests a gender-balanced involvement, a positive indication for inclusive agriculture. The majority of the respondents (43.8%) are high school graduates, with 27% having some exposure to college education. This reflects a moderate educational background, which may influence the adoption of modern or scientific farm practices. Santiago and Roxas (2015) stated that while many farmers in the Philippines attain only basic education, those with higher education levels are more likely to adopt innovations and access government programs.

Most farmers have intensive experience, with 34.8% having 21-25 years and 24.7% having more than 25 years in sugarcane farming. This reflects a deep-rooted farming culture with knowledge possibly passed down through generations. Maramara (2022) emphasized that experience can often compensate for a lack of formal education in traditional farming sectors, as experienced farmers rely on time-tested practices. Most respondents (66.3%) are farm owners, which can significantly influence farm investment decisions and long-term planning. This finding implies that farm owners have greater autonomy in making farming decisions, which can drive long-term investment and productivity growth.

3.2 Farm Profile of the Respondents

As shown in Table 2, the majority of respondents (55.1%) reported having hilly or rolling farm topography, indicating that most sugarcane farms are situated on uneven terrain. The uneven topography may pose difficulties for mechanized farming, requiring specialized equipment designed for slopes or necessitating a reliance on more labor-intensive methods for tasks such as planting and harvesting. Madugundo et al. (2022) noted that hilly terrains often lead to lower yields due to challenges with water retention and erosion. This highlights the potential implications for farm productivity. However, the hilly landscapes also offer advantages, such as reduced flood risks, which could be crucial in areas prone to heavy rains or flooding.

Table 2. *Frequency and Percentage Distribution of the Farm Profile of the Respondents*

Indicators	Frequency	Rf (%)
Farm Topography		
Flat	33	37.10
Hilly/Rolling	49	55.10
Others, Mixed Topography	7	7.90
Total	**89**	**100.00**
Cane Variety		
8013	9	10.10
862	19	21.30
2K-11	2	2.20
2K-171	17	19.10
7139	30	33.70
Others, Mixed Variety	12	13.50
Total	**89**	**100.00**
Harvest Cycle		
New Plant	3	3.40
Ratoon	78	87.60
Others, Mixed Cycle	8	9.00
Total	**89**	**100.00**
Water Source		
Rainwater	88	98.90
Reservoir	1	1.10
Total	**89**	**100.00**

The most popular sugarcane variety was 7139, with 33.7% of the farmers selecting this variety. In contrast, the 2k-11 variety recorded the lowest preference, with only 2.2% of farmers choosing it. The dominance of 7139 suggests that it is considered superior in terms of yield and resilience, making it the preferred choice for most farmers. Moreover, the lack of interest in 2K-11 could signal a need for further research and development to improve its characteristics and make it more attractive to farmers. The overwhelming majority of farmers (87.6%) were in the ratoon stage, which has the most significant value in the dataset, while only 3.4% of farmers engaged in new planting. However, Dlamini et al. (2024) warn that continuous ratoon cropping without replenishing soil nutrients can lead to soil depletion, reduced yield, and lower profitability over time.

The vast majority of farmers (98.9%) rely solely on rainwater as their primary water source for sugarcane production on their farms. Only one respondent (1.1%) reported using a reservoir, while none indicated the use of other alternatives such as deep wells or mechanical pumps. This overwhelming dependence on rainfall highlights a significant vulnerability in the sustainability of sugarcane farming in the studied regions. According to Kocabas et al. (2015), rain-fed systems in the Philippines are highly susceptible to water scarcity, particularly during dry spells. The near absence of reservoir usage and complete lack of other water sources suggests limited access to water infrastructure and a possible gap in both public and private investment in water management systems.

3.3 Factors Affecting Sugarcane Production

Results in Table 3 showed strong agreement across all factors, with mean scores ranging from 4.61 to 4.69. This suggests that respondents perceived these factors as crucial for the production of sugarcane. Specifically, among the seven factors, economic and social factors have the highest mean score (4.69), which are considered to be the most significant contributors to sugarcane production in the provinces. The high results reflect farmers' strong concerns with price, input costs, and access to credit, as well as the significance of community and labor dynamics in the production process. A study conducted by Huang and Xiong (2019) revealed that an inadequate policy framework frequently exacerbates environmental stressors on crops such as sugarcane by failing to provide sufficient resources. Similarly, Zulu et al. (2019) highlighted that institutional factors such as limited extension services negatively impact sugarcane farmers in South Africa.

Table 3. *Standard Deviation and Mean of the Factors Affecting Sugarcane Production*

Factors	Standard Deviation	Mean	Remarks
Economic	**0.38**	**4.69**	**Strongly Agree**
Agricultural	0.39	4.61	Strongly Agree
Environmental	0.39	4.61	Strongly Agree
Social	**0.27**	**4.69**	**Strongly Agree**
Technological	0.24	4.67	Strongly Agree
Politics & Institutional	0.39	4.62	Strongly Agree
Infrastructure	0.29	4.67	Strongly Agree
Overall	**0.34**	**4.65**	**Strongly Agree**

Given that a majority (74.2%) of the respondents came from Davao del Sur, these results are most reflective of the experiences and priorities of farmers in the province. It can be inferred that in Davao del Sur, economic and social support systems are either well-established or seen as crucial for continued success in sugarcane farming. In the case of Sarangani and South Cotabato, although these regions had fewer respondents, the inclusion adds diversity to the data, contributing to a broader understanding of how farmers across different contexts perceive these key factors.

3.4 Sugarcane Farmers' Planting Intentions

Table 4 revealed the sugarcane farmers' planting intentions in the provinces of Davao del Sur, Sarangani, and South Cotabato. Results showed a consistently firm intention to continue planting sugarcane, with all statements receiving high mean scores ranging from 4.69 to 4.93. The overall mean of 4.82, accompanied by a low standard deviation of 0.40, indicates that farmers "always" intend to continue planting sugarcane. Notably, statement 7, which is related to favorable weather conditions, received the highest mean score (4.93) and the lowest standard deviation (0.25). This indicates an almost unanimous agreement that good weather remains a strong motivator in farmers' intention to continue planting. This aligns with the findings in Fiji, which revealed that despite various climatic challenges, sugarcane farmers remain committed to cultivation, affirming the role of internal motivation and industry attachment in shaping planting behavior (Hidalgo et al., 2024).

3.5 Relationship between the Factors Affecting Sugarcane Production and Farmers' Planting Intentions

Table 5 presents the results of the correlation analysis between the identified factors and the planting intentions of sugarcane farmers across Davao del Sur, Sarangani, and South Cotabato. Among all the factors, the economic factor exhibits the strongest positive relationship with farmers' planting intentions, reflected by an R-value of 0.678 and a P-value of <0.001, indicating a strong and statistically significant relationship. This implies that farmers

are highly responsive to changes in economic conditions such as prices, input costs, and access to financial support.

Locally, Eleazar et al. (2024) emphasized that economic returns serve as a significant motivation for continued involvement in sugarcane production, suggesting that profitability remains central to farmers' decision making Interestingly, the technological factors presented the weakest relationship (R=0.158) and were not statistically significant (P=0.138), suggesting that access to or use of modern farming technologies, machinery and innovations is not a significant determinant of planting intention among the surveyed farmers. Although technological factors received high mean ratings in both the measurement of production elements and planting intention, indicating that farmers perceived technology as beneficial, correlation analysis revealed no statistically significant relationship between technological factors and actual planting decisions. The discrepancy could be attributed to limited actual access to technology, the transfer of information, or the predominant topography of the sugarcane farms, which is hilly and rolling. The insignificant relationship may be explained by a study that emphasizes that technologies, by their very nature, are merely tools whose effectiveness depends on context and accessibility. Technologies are not universally empowering unless they align with the specific needs and realities of the users (Barbera, 2021). Having a large majority from Davao del Sur, these relationships may primarily mirror the conditions in that province and may not fully capture the dynamics in Sarangani and South Cotabato.

Table 4. *Standard Deviation and Mean of Farmers' Planting Intentions*

Statements	Standard Deviation	Mean	Remarks
1	0.37	4.90	Always
2	0.47	4.85	Always
3	0.34	4.87	Always
4	0.38	4.87	Always
5	0.40	4.84	Always
6	0.40	4.80	Always
7	0.25	4.93	Always
8	0.36	4.85	Always
9	0.54	4.69	Always
10	0.41	4.79	Always
11	0.40	4.80	Always
12	0.38	4.83	Always
13	0.45	4.76	Always
14	0.47	4.74	Always
15	0.43	4.76	Always
16	0.45	4.78	Always
17	0.45	4.78	Always
18	0.54	4.73	Always
19	0.38	4.87	Always
20	0.37	4.84	Always
21	0.37	4.88	Always
22	0.30	4.90	Always
Overall	**0.40**	**4.82**	**Always**

Table 5. *Significant Relationship between Factors Affecting Sugarcane Production and Farmers' Planting Intention*

Factors	Farmer's Production Intention			
	R-value	Degree of Relationship	P-value	Interpretation
Economic	**0.678**	**Strong**	**<0.001**	**Significant***
Agricultural	0.576	Moderate	<0.001	Significant*
Environmental	0.495	Moderate	<0.001	Significant*
Social	0.502	Moderate	<0.001	Significant*
Technological	**0.158**	**Very Weak**	**0.138**	**Not Significant**
Politics & Institutional	0.491	Moderate	<0.001	Significant*
Infrastructure	0.390	Weak/Slight	<0.001	Significant*

*Correlation is significant at the 0.05 level

3.6 Factors that have the Greatest Relationship to Farmers' Planting Intentions

Table 6 results underscore the primacy of economic factors in influencing sugarcane farmers' planting intentions, as the only statistically significant predictor, indicating a strong and positive effect on planting intentions. This implies that farmers are most responsive to economic returns such as price, production costs, and access to

financial sources, a finding aligned with Rout and Bar (2015), who observe that farmers tend to avoid sugarcane if it becomes less lucrative than other crops. The findings further showed a strong overall relationship between the combined factors and planting intention, as reflected by an R-value of 0.703. Additionally, the coefficient of determination ($R2 = 0.494$) means that 49.4% of the variation in planting intentions can be explained by the factors included in the model, particularly economic ones. The remaining 50.6% of the variation may be attributed to other factors not measured in this study, such as individual experiences and cultural norms.

Table 6. *Multiple Regression Analysis of the Factors Affecting Sugarcane Production and Farmers' Planting Intentions*

	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standard Error	Beta		
(Constant)	3.086	0.316		9.769	<0.001
Economic	**0.234**	**0.062**	**0.530**	**3.777**	**<0.001**
Agricultural	0.101	0.064	0.230	1.588	0.116
Environmental	-0.060	0.057	-0.141	-1.055	0.295
Social	0.079	0.071	0.130	1.117	0.267
Technological	-0.016	0.071	-0.023	-0.225	0.822
Politics and	-0.016	0.052	-0.043	-0.308	0.759
Institutional Infrastructure	0.048	0.064	0.083	0.752	0.454

Model Summary: R=0.703; R^2=0.494 or 49.4%

4.0 Conclusion

The agricultural sector faces challenges due to an aging farmer population, with limited participation from younger individuals, which may lead to labor shortages. While gender representation is balanced, many farmers have low educational attainment, which may hinder the adoption of modern techniques. Despite extensive farming experience, embracing new methods remains a challenge. Additionally, land tenure security is crucial, especially for lessees who might encounter obstacles in making long-term improvements to their farms. Reliance on hilly or rolling terrains presents challenges for mechanized farming, requiring more manual labor and specialized equipment. The heavy dependence on rainwater for irrigation underscores the vulnerability of these farmers to unpredictable rainfall patterns, which may be exacerbated by climate change.

The consistent "strongly agree" ratings across all categories suggest that sugarcane farmers recognize the multidimensional nature of agricultural productivity. Economic and social factors appear to be the most prominent, likely due to their direct impact on farm operations, market access, labor availability, and community support. Economic considerations are the most crucial determinant of planting intentions among sugarcane farmers in the study area. The unexplained variance (50.6%) suggests the influence of non-measured variables, such as individual motivation, cultural values, and external shocks, which are beyond the scope of the study. While the insights derived from medium- and large-scale farmers offer a valuable understanding, they may not fully reflect the conditions in Sarangani and South Cotabato, where the number of qualified farmers was comparatively low. This limitation potentially constrains the external validity of the study and its ability to generalize findings to the provinces due to the sample's restricted representativeness.

Based on the findings, the Department of Agriculture and State Universities and Colleges should launch youth-targeted agricultural programs on modern sugarcane farming techniques. Government agencies should introduce mechanization suited for hilly and rolling terrains, including irrigation projects, to reduce reliance on rainwater and provide production support programs and policy efforts that strengthen market prices, minimize costs, and ensure access to affordable credit for the sustainability of sugarcane farming. It is equally important to recommend, in future studies, ensuring a proportionate distribution of respondents and expanding across other regions to accurately capture diversified dimensions.

5.0 Contributions of Authors

Ijade T. Granada: conceptualization, data collection, formal analysis, writing the original draft, and preparation. Mark Jude F. Trondillo: supervision, guidance on research design and methodology, critical review of the manuscript.

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7.0 Conflict of Interests

The authors declare no competing interests.

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