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Profitability of cacao (*Theobroma cacao* L.) production in the selected areas of Misamis Oriental

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Abstract This study assessed the profitability of cacao production in Claveria and Gingoog City, Misamis Oriental, from 2019 to 2021. Findings of the study showed that the relationship between socio-demographic profile, level of knowledge of farmers, and return on investment were not statistically significant based on Pearson's r correlation in 2019, 2020, and 2021. However, Gingoog City significantly differed in total income and expenses from Claveria, Misamis Oriental, with 50%, 43.46%, and 44.72% return on investment of Claveria in 2019, 2020, and 2021while 58.08%, 63.86%, and 62.14% return on investment of Gingoog City in 2019, 2020, and 2021 respectively. The study found that Gingoog City's net income increased in 2019, 2020, and 2021 by Php 20,073.33, Php 22,313.34, and Php 20,880, respectively. Gingoog City generated higher income in 2019 (Php 35,480.00), 2020 (Php 37,166.67), and year 2021 (Php 36,166.67) than Claveria, Misamis Oriental in 2019 (Php 15,406.67) 2020 (Php 14,853.33), and year 2021 (Php 15,286.67).

Keywords: Level of knowledge, Management practices, Return on investment

Introduction

Cacao, scientifically known as *Theobroma cacao* L., stands as a tropical evergreen tree valued for its edible seeds. Originating from Central and South America, its cultivation ventured into Asia with the Philippines pioneering in 1670 (Cook, 2023; Vega and Kwik-Uribe, 2012). Over time, commercial farms sprouted, transforming cacao into a significant economic engine in various nations worldwide, especially in tropical regions like Africa, Latin America, and parts of Asia. The cacao industry's importance amplifies amidst the widening supply and demand imbalance of cocoa beans, leading to increased attention both domestically and internationally (Bureau of Plant Industry, 2017).

The escalating global demand for cacao, tripling since 1970 and growing at an annual rate of 3%, showcases its economic promise. Notably, countries such

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as China and India witness even more substantial growth rates, reaching 7.9% (Aikpokpodion, 2010). Positioned advantageously within 20 degrees of the equator, the Philippines emerges as a prime location for cacao production, with the Davao Region spearheading production, accounting for 78.7% of the total output in early 2022 (Philippine Statistics Authority, 2022). This surge in the cacao sector is fueled by burgeoning middle-class populations, increased disposable incomes in emerging economies, and innovative applications of cocoa across diverse industries, spanning food, cosmetics, and pharmaceuticals (DA and DTI).

However, amidst its promising trajectory, the cacao industry faces multifaceted challenges. Junaid (2015) highlights critical issues such as low cocoa plant yields, rampant pests and diseases, insufficient agricultural knowledge and skills among farmers, and soil degradation. Additionally, many cocoa farms grapple with aging infrastructure, with some operating for over 25 years (Nabua *et al*., 2013). These challenges not only imperil cocoa production but also undermine its competitive stance against other lucrative crops like palm oil and corn. Junaid (2015) underscores the prevalence of low cocoa yields and the formidable presence of pests and diseases. Notably, pests like the cocoa pod borer and diseases such as black pod disease are major concerns, leading to diminished productivity and financial losses. Marelli *et al*. (2019) elaborate further on the detrimental impacts of these factors, stressing the urgent need for effective mitigation strategies. Nabua *et al*. (2013) shed light on the deficiency in agricultural expertise among cocoa farmers, particularly smallholders. This knowledge gap hinders the implementation of effective pest and disease management practices, exacerbating yield losses and economic setbacks.

The aging infrastructure of cocoa farms, as noted by Nabua *et al*. (2013), contributes to soil degradation and reduced mineral content. This degradation, coupled with dwindling yields, heightens susceptibility to pests and diseases, posing substantial challenges to farmers and jeopardizing the long-term sustainability of cocoa production. Even though its economic potential, cocoa finds itself in a vulnerable position compared to other crops like palm oil and corn, as emphasized by Junaid (2015). Factors such as low yields, pest and disease pressures, and inadequate post-harvest processing facilities undercut the industry's competitiveness, compromising its ability to command favorable prices in global markets.

Even with these challenges, the Department of Agriculture (DA) and Department of Trade and Industry (DTI) recognize cacao's potential to contribute to poverty reduction and inclusive growth. Cacao production requires only minimal financial investment or start-up capital, which is why small farm holdings account for 90% of the growers. The excellent profitability and early

return on investment of cacao products provide good income augmentation potential. Furthermore, cacao's adaptability as a food and non-food item ensures a long-term commercial possibility (2017-2022 Philippine Cacao Roadmap).

Despite significant competitive advantages, the Philippines' participation in the cocoa-chocolate engagement is limited (DTI, 2017). When it comes to cacao production, there are many different options and prospects. Demand for cacao-based products is increasing, but the supply of these items is still insufficient in domestic and international markets (Lirag, 2021). Considering the growing global demand for cacao beans, commercial production of cacao is one of the recommended activities included in the Philippines' 2017-2022 Investment Priorities Plan and Philippine Cacao Industry Road Map. Due to its climate and favorable geographic location, the Philippines is suitable for cacao production and accessibility to both domestic and international trade. Local farmers and exporters have become more motivated to advocate for a more dynamic and competitive cacao industry that can compete with other major cacao-growing nations, such as Brazil and Colombia (DTI, 2017).

Thirty-two (32) farmers of the Cacao Farmers Association in Claveria (CFAC) officially received the cacao post-harvest and processing equipment and facility from the Department of Trade and Industry (DTI) Misamis Oriental's Shared Service Facilities (SSF) program. The SSF worth P1.02M comprises of fermentation box, solar dryer, roasting machine, sheller, and grinder. The turnover is significant in providing efficient post-harvest and processing facilities for cacao farmers to develop the Philippine Cacao Industry by enhancing the characteristics and quality of cocoa and considering the Philippine market position of producing and exporting fine, tasty tablea (DTI, 2021).

However, there is confused around the pricing of cacao products. This was particularly noted in the pricing of a small cup of sekwati in various cafés and snack bars in Claveria, Misamis Oriental. Thus, this study conducted to assess the profitability of cacao producers and cacao production in Claveria, and Gingoog City, Misamis Oriental.

Materials and methods

Setting

This research was conducted in Claveria and Gingoog City, Misamis Oriental focusing on the different cacao farmers in the said locality/city.

Sampling procedure

The method of purposive sampling was strategically chosen to determine the participants of the study. This approach, classified as a non-probability sampling technique, entails the deliberate selection of individuals based on predefined criteria or specific attributes that hold significance within the context of the research investigation.

Identification of the respondents

The study's respondents were 15 cacao growers in Claveria, Misamis Oriental, and 15 cacao growers in Gingoog City, Misamis Oriental cultivated 800 to 8,000 cacao trees planted. The respondents were selected randomly based on the data from the municipal/city agriculture office (MAO/CAO). The respondents of the study were as follows:

Table 1. The number of respondents in the selected areas in Misamis Oriental

AREA	NUMBER OF RESPONDENTS
Claveria, Misamis Oriental	
Barangay Aposkahoy	3
Barangay Mat-I	3
Barangay Poblacion	3
Barangay Sta. Cruz	3
Barangay Patrocenio	3
Gingoog City, Misamis Oriental	
Barangay Lunotan	3
Barangay Agay-ayan	3
Barangay Mimbunga	5
Barangay Malinao	3
Barangay San Miguel	1
Total	30

Instrument of the study

The study used a descriptive survey method. Semi-structured survey questionnaire as the primary tool for gathering the data. The questionnaire was written in English and translated into the local language to ensure accurate and reliable data were collected. The survey questions had four (4) parts: the first one was the socio-demographic profile of the respondents; the second one was the cost and return of cacao production; the third one was the factors affecting the profitability of cacao production; and lastly was the level of knowledge of farmers on cacao production.

Ethical consideration

Amid the pandemic, data collection occurred physically while meticulously adhering to the stringent protocols established by the Inter-Agency Task Force (IATF). This approach was chosen to ensure all respondents' safety, well-being, and rights. Every interaction, whether conducted virtually or in person, was conducted in alignment with the health and safety guidelines stipulated by relevant authorities.

The informed consent procedures underwent adaptation to encompass a comprehensive account of the potential COVID-19-related risks. The researcher obtained explicit consent from participants, highlighting the voluntary nature of their participation in the study. Assurances were provided regarding the secure storage of all collected information, with exclusive access granted solely to authorized research personnel. This approach was integral to maintaining the privacy of the respondents. A meticulous anonymization process was undertaken as part of data analysis and reporting, ensuring that participant data remained confidential. All identifiers were intentionally segregated from the research findings, thereby upholding the integrity of the information gathered.

Data collection quality control

The collection of data for the study was thoroughly organized and carried out. The survey instrument was pre-tested on selected farmers in Claveria before the interview to check its readability and establish the time allotment required for each respondent during the survey. Before its final reproduction, the instrument underwent additional improvement following the pre-testing. The members of the survey team and the enumerators participated in a mock interview to practice conducting the interview procedure after receiving training to gauge their comprehension of the questionnaire's content. The researchers and team leaders closely monitored the interviewers during the survey to make sure the protocol was followed, and that the interviewer could appropriately interpret the context of the inquiry. In cases where the study team found that the respondents' responses needed to be verified, a follow-up phone call was made to them. The data-gathering method was carefully designed and carried out to guarantee the authenticity and correctness of the data acquired for the study.

Data processing and analysis

After data collection, the survey results were processed, consolidated, tabulated, and analyzed using statistical software. Several statistical techniques were used to analyze the data including frequency, percentage distribution, and weighted mean. The weighted mean was used to determine the average value of the responses to each item in the questionnaire. Pearson's r correlation was used to measure the relationship between the socio-demographic profile of farmers, the level of knowledge of farmers on cacao farming, and return on investment and independent t-test was used to compare the significant difference in total income, total expenses, net income, and return on investment of Claveria and Gingoog City cacao farmers.

Results

Demographic profile

Findings revealed that most cacao farmers (66.70%) fall into the middle age (40-59), with an average age of 56. About 3.33% were between the ages of 39 and below (young), and 30% were 60 and above (Table 2). The study showed that the respondents were dominated by males, who comprise 60% of the total, while females contain only 40% of the total respondents. About 86.70% of the respondents were married, and 3.33% were widowed and separated. Additionally, 63.60% of the respondent's income came from farming, and 2.33% from piggeries, professional practice (doctor), and land title processing. Most respondents (40%) have earned a college degree, whereas 6.70% have completed elementary school. These imply that education significantly facilitates cacao growers, improving farmers' understanding and knowledge of new farm technologies.

Socio-economic profile

The data showed that 93.33% of the respondents are farm owners, while 3.33% are family owned and are in a position to cultivate cacao. The analysis explained that 36.70% of the respondent's own land of 2.1-4 hectares and only 10% own land of 10.1 hectares and above as shown in Table 3. The majority (46.70%) cultivated their land with an area of 0.5-2 hectares, while only 3.33% of individuals cultivated land with an area of 10.1 hectares and above. Out of the total respondents interviewed, 66.70% of them who own land with an area of 0.5-2 hectares have planted cacao, while only 16.66% who own land with an area of

2.1-6 hectares have planted cacao. Based on the farming industry, 93.33% of the respondents are single owners, while 6.66% are from farm partnerships. The data presented that most of the respondents in the study (68.60%) used bank loans as their source of capital for their farming activities, while 31.40% were self-financed.

Table 2. Demographic characteristics of the respondents in the selected areas in Misamis Oriental

FARMER'S PROFILE		FREQUENCY (N=30)	PERCENT (%)
Age (56%)			
	39 and below (Young)	1	3.33
	40-59 (Middle Age)	20	66.70
	61 and above (Senior)	9	30.00
Gender			
	Male	18	60.00
	Female	12	40.00
Marital Status			
	Single	2	6.70
	Married	26	86.70
	Widowed	1	3.33
	Separated	1	3.33
Source of Income			
	Farming	28	63.60
	Professional practice	1	2.33
	Government employee	7	15.90
	Land title processor	1	2.33
	Sari-sari store	6	13.60
	Piggery business	1	2.33
Educational Attainment			
	Elementary graduate	2	6.70
	High school level	4	13.33
	High school graduate	5	16.70
	College level	7	23.33
	College graduate	12	40.00

Table 3. Socioeconomic characteristics of the respondents in the selected areas in Misamis Oriental

FARM PROFILE		FREQUENCY (N=30)	PERCENT (%)
Land Tenurial Status			
	Farm owner	28	93.33
	Family owned	1	3.33
	Right in position	1	3.33
Total Land Area Planted with Cacao			
	0.5-2 hectares	20	66.70
	2.1-4 hectares	5	16.66
	4.1-6 hectares	5	16.66
Farming Business			
	Single owner	28	93.33
	Partnership	2	6.66
Source of Capital			
	Self-financed	11	31.40
	Bank loan	24	68.60

Cost and return analysis

Statistics showed that Gingoog City had a higher average yield than Claveria in all three years, with Gingoog City's yield ranging from 855.33 kg per hectare in 2019 to 851.67 kg per hectare in 2021. Nevertheless, the yield decreased by two (2) kg per hectare from 2019 to 2020 and 1.66 kg per hectare from 2020 to 2021, while Claveria's yield ranged from 409.33 kg per hectare in 2019 to 438.00 kg per hectare in 2021. Claveria's yield increased by 24 kg per hectare from 2019 to 2020 but only by 4.67 kg per hectare from 2020 to 2021. The average selling price was the same for both Claveria and Gingoog City in 2020 and 2021, was a significant difference in 2019. Claveria had a much lower selling price of Php 96.00 per kg than Gingoog City's price of Php 146.67 per kg. This difference in selling price likely contributed to the difference in total income between the two locations in 2019. Gingoog City consistently had a higher total income than Claveria over the past three years. In 2021, Claveria's total income was Php 49,466.67 per hectare, compared to Gingoog City's total income of Php 94,366.67 per hectare. This difference could be due to the difference in average yield and other factors such as expenses and marketing strategies. In 2019, Claveria had a return on investment of 50%, while Gingoog City had a return on investment of 58.08%. In 2020, Claveria's return on investment decreased to 43.46%, while Gingoog City return on investment increased to 63.86%. In 2021, Claveria's return on investment increased to 44.72%, while Gingoog City return on investment decreased slightly to 62.14%. This observed that Gingoog City had a consistently higher return on investment than Claveria for all three years (2019, 2020, and 2021) (Table 4).

Table 4. Cost and return analysis of cacao production in Claveria and Gingoog City, Misamis Oriental, from 2019-2021

PARTICULARS	CLAVERIA, MISAMIS ORIENTAL			GINGOOG CITY, MISAMIS ORIENTAL		
	2019	2020	2021	2019	2020	2021
Ave. Yield (kg)	409.33	433.33	438.00	855.33	853.33	851.70
Selling Price (₱)	96.00	112.00	112.00	146.70	146.70	146.70
Total Income	45,986.70	49,033.33	49,466.70	96,566.70	95,366.70	94,366.70
Production Expenses	22,093.33	24,793.33	24,793.33	45,366.70	42,480.00	42,480.00
Post-harvest Expenses	5,300.00	5,800.00	5,800.00	9,300.00	9,300.00	9,300.00
Marketing Expenses	3,186.70	3,586.70	3,586.70	6,420.00	6,420.00	6,420.00
Total Expenses	30,580.00	34,180.00	34,180.00	61,086.70	58,200.00	58,200.00
Net Income	15,406.70	14,853.33	15,286.70	35,480.00	37,166.70	36,166.70
ROI	50.00%	43.46%	44.72%	58.08%	63.86%	62.14%

Income statement analysis

In 2019, a significant difference in gross income was found (0.036) between Claveria and Gingoog City. Significantly, Gingoog City had a higher gross income (Php 96,566.67) than Claveria (Php 45,986.67). Similarly, in 2020 and 2021, the significance levels are 0.022 and 0.020, respectively, indicating statistically significant differences between Claveria and Gingoog City, with Gingoog City having higher gross income in both years. In terms of the return on investment of the respondents of both municipalities, there was a significant difference found in 2019 between Claveria and Gingoog City with a significant value of 0.043, with Gingoog City having a higher return on investment (58.08%). 2020 the significance level is 0.058, indicating no statistically significant difference between Claveria and Gingoog City. However, in 2021, a significant difference (0.047) was found between Claveria and Gingoog City, with Gingoog City having a higher return on investment of 62.14%. In contrast, Claveria had a return on investment of 50% (Table 5).

Claveria and Gingoog City showed statistically significant differences in their total income, total expenses, and return on investment in different years. At the same time, there is no statistically significant difference in total expenses in most years' caution. The profitability variables were probably comparable in both years, resulting in a comparable return on investment. Overall, the findings showed that various factors can affect how profitable cacao farming is and that thorough monitoring and analysis are required to pinpoint the significant

contributors to profitability and make strategic decisions about farm management.

Table 5. Income statement of cacao production in Claveria and Gingoog City, Misamis Oriental from 2019-2021

CATEGORY	CLAVERIA, MISAMIS ORIENTAL	GINGOOG CITY, MISAMIS ORIENTAL	SIG.
	CY: 2019	**CY: 2019**	
Total Income	45,986.67	96,566.67	0.036*
Total Expenses	30,580.00	61,086.67	0.094^{ns}
Return On Investment	50.00%	58.08%	0.043*
	CY: 2020	**CY: 2020**	
Total Income	49,033.33	95,366.67	0.022*
Total Expenses	34,180.00	58,200.00	0.054*
Return On Investment	43.46%	63.86%	0.058^{ns}
	CY: 2021	**CY: 2021**	
Total Income	49,466.67	94,366.67	0.020*
Total Expenses	34,180.00	58,200.00	0.054*
Return On Investment	44.72%	62.14%	0.047*

* = significant at a 5% level, ns = not significant

Factors affecting profitability in cacao production

The results showed the factors affecting profitability, including the management practices of cacao farmers. In cacao farming, 60% of cacao growers work full-time, compared to 40% of the respondents working part-time. Most of the respondents (90%) agreed that cacao harvested at around 90 days (3 months) during flowering. Environmental factors such as wind, excessive heat, etc., are the main concerns encountered by our cacao growers with (36.80%) of the total respondents interviewed, whereas improper cacao pruning accounts for only 1.33% of the respondents encountered this problem in their cacao production. Environmental factors such as climate, soil, pests, diseases, and biodiversity can all significantly impact cacao production as shown in Table 6.

Table 6. Factors affecting profitability in terms of management practices of cacao production in selected areas in Misamis Oriental

MANAGEMENT PRACTICES	FREQUENCY (N=30)	PERCENT (%)
Committed to Cacao Farming		
Full time	18	60.00
Part-time	12	40.00
Days of Cacao Harvested during Flowering		
90 days	27	90.00
120 days	1	3.33
180 days	2	6.70
Problems Met in Cacao Production		
Diseases	23	30.33
High price inputs	20	26.33
Damaged during harvest	4	5.33
Environmental factors	28	36.80
Improper pruning	1	1.33

Marketing

Most of the respondents (93.33%) of cacao farmers sell their produce. Among the 30 respondents, 43.33% of them sold their cacao produce at Php 100.00 per kilo, whereas 3.33% of the respondents sold their produce at Php 80.00 per kilo respectively, and 86.70% of the respondents agreed that the buyer sets the price, while 13.33% of them said that they set the pricing of the cacao beans of 30 respondents, 16 or 35.55% said that their neighbors and assembler-wholesalers are their market outlet, while Kennemer Foods International accounts for 28.90% of the total respondents (Table 7).

Buyers could include individual customers, businesses, or other intermediaries who prefer to handle the transportation themselves, perhaps for convenience or cost-effectiveness. Regarding packaging materials expense, 96.70% was shouldered by the cacao sellers, while the buyer's markup was 3.33% only. The buyers shouldered transportation expenses (61.10%), while sellers got only 38.90%.

Table 7. Factors affecting profitability in terms of marketing cacao production in the selected areas in Misamis Oriental

MARKETING	FREQUENCY (N=30)	PERCENT (%)
Selling in Cacao Beans		
Yes	28	93.33
No	2	6.70
Reasons Why Not 100% in Selling		
Damaged	2	18.20
Family consumed	6	54.50
Process tablea	3	27.33
Market Outlet of the Product		
Assembler wholesalers	16	35.55
Neighbors	16	35.55
Kennemer Foods International (KFI)	13	28.90
Packaging Expenses were Shouldered By		
Buyers	1	3.33
Sellers	29	96.70
Transportation Expenses were Shouldered By		
Buyer	22	61.10
Seller	14	38.90

Level of knowledge of farmers in cacao production

Training attended

The level of knowledge of farmers in Claveria and Gingoog City, Misamis Oriental, acquired through training attended, 5-7 years were 76.70% being the highest and 3-4 years were 6.70% being the lowest. The data on the number of trainings attended related to cacao production shows that the farmers had low (1-2) training, or 50%, and medium (3-4) training, or 20%. It tells that the farmers lack yearly training in growing cacao and expanding their production (Table 8).

Table 8. Level of knowledge of cacao farmers in terms of training attended in the selected areas in Misamis Oriental

TRAINING ATTENDED	FREQUENCY (N=30)	PERCENT (%)
Years Engaged in Cacao Farming		
3-4 years	2	6.70
5-6 years	23	76.70
7-8 years	5	16.70
Number of Training Attended Related to Cacao Production		
Low (1-2)	15	50.00
Medium (3-4)	6	20.00
High (5 above)	9	30.00

Cultural practices

The farmers preserved the fertility of their land, showing that they applied organic fertilizer, being the highest with 49% in growing cacao, whereas compost from the pulp of cacao was the lowest with 6.30%. The data showed that the farmers were knowledgeable enough about the positive effect on the environment of the application of organic fertilizers. Compost made from cacao pod husk and manure also serves as an alternative source of fertilizer for farmers. In the manual approach, 81.50% of the respondents mentioned that they take one (1) to three (3) days to complete the manual work, whereas 18.50% responded for four (4) to seven (7) days to finish. About 60% of the farmers applied herbicide using Karate in their cacao production, and weeding was required to prevent the cacao tree and to avoid competing for nutrients. Based on the data, the most common or preferred duration for applying fertilizers to the cacao farmers is one (1) to two (2) days which has the highest response accounting for 83.40% of the total. Three (3) to four (4) days have lesser responses comprising 5 or 16.60%. The data presented that every year, 96.70% involve 1-4 persons operating the harvesters, while 3.33% only of the respondents stated that they need 9-12 persons operating the harvesters. Lastly, the findings indicated that 66.70% of the respondents took 1-2 days to finish harvesting the cacao, while 33.33% took 3-4 days to finish harvesting. The level of knowledge of cacao growers can impact the cacao business in terms of the quality of cacao, productivity, innovation, sustainability, and access to markets (Table 9).

Correlation analysis

The data provided appears to be correlation coefficient and significance (sig.) values for various variables across three (3) years; 2019, 2020, and 2021 revealed in Table 10. On the data provided, the variable "marital status" has the highest positive correlation coefficient of (r=0.217) among the variables in 2019, which is above the commonly used threshold of 0.05 for statistical significance, while the source of income with (r=001) is the lowest correlation coefficient. However, the relationship is not significant. All other explanatory variables are negatively related to profitability except age (r=0.163), the total land area planted with cacao (r=0.009), and type of farming business (r=0.001). 1n 2020, among the variables listed, the highest correlation coefficient is (r=0.215), associated with marital status.

This indicated a weak positive correlation between marital status and profitability. Married individuals tend to have a slightly higher value for the dependent variable compared to unmarried individuals.

Table 9. Level of knowledge of farmers in terms of cultural practices in the selected areas in Misamis Oriental

CULTURAL PRACTICES	FREQUENCY (N=30)	PERCENT (%)
Preserve Soil Fertility		
Organic fertilization	23	49.00
Compost from the pulp of the cacao	3	6.30
Synthetic fertilization	21	44.70
Weeding Techniques were Utilized		
Chemical method	3	10.00
Manual method	27	90.00
Type of Herbicide used in Chemical Weeding		
Clear-out	2	40.00
Karate	3	60.00
Month Applying Fertilizer per Year		
1-3 months	6	20.00
4 -7 months	24	80.00
Type of Fertilizer in Cacao Farming		
Complete fertilizer	24	75.00
Bonaterra	4	12.50
Organic fertilizer	4	12.50
No. of Days Finished Applying Fertilizer in Cacao Farming		
1-2 days	25	83.40
3-4 days	5	16.60
Harvester per Year		
1-4 persons	29	96.70
9-12 persons	1	3.33

On the other hand, the lowest correlation coefficient is (r=-0.001), which is associated with the source of income. This means an extremely weak negative correlation between the source of income and its profitability. The source of income has almost no influence on the profitability of cacao production. All explanatory variables are negatively related to profitability except age (r=0.163) and total land area (r=0.072), while the relationship of all explanatory variables is not statistically significant to the response variables. For 2021, the highest correlation coefficient is 0.266, which corresponds to the variable "marital status"; this indicated a moderate positive correlation between marital status and profitability. Lowest positive correlation coefficient is (r=0.060), which corresponds to the variable "age"; this indicated a moderate positive correlation between age and profitability. This suggest that age has a moderate influence on the profitability of cacao production.

However, the relationship between all the explanatory variables and the profitability is not statistically significant. In summary, the variable "marital status" has the highest positive correlation coefficient in all three years (2019, 2020, and 2021), suggesting that marital status may have a significant influence

on the profitability of cacao production throughout these years. But correlation coefficient of marital status is statistically not significant, which means we don't have sufficient or enough evidence to support the claim that there is an accurate relationship between marital status and the profitability of cacao production in both Claveria and Gingoog City in three consecutive years from 2019, 2020, and 2021 respectively.

It is possible that the socio-demographic profile of farmers is not significant to return on investment in cacao farming, while socio-demographic factors such as age, gender, education, marital status, and source of income may play a role in farming practices, they may not have an immediate effect on the farm's financial performance.

The return on investment of the cacao industry is often impacted by a number of variables, including cultivation techniques, input quality, market demand, and production efficiency. For example, farmers who invest in high-quality seeds, fertilizers, and pest management may increase the yield of cacao trees, resulting in higher revenue and a return on investment. Similarly, farmers who adopt value-added processing methods such as chocolate production may be able to command a higher price for their cacao beans, leading to a better return on investment.

Table 10. Correlation analysis on the socio-demographic profile of cacao farmers and return on investment from 2019-2021 in the selected areas of Misamis Oriental

VARIABLES	2019		2020		2021	
	Correlation Coeff.	Sig.	Correlation Coeff.	Sig.	Correlation Coeff.	Sig.
Age	-0.031	0.87^{ns}	0.163	0.41^{ns}	0.060	0.75^{ns}
Gender	-0.263	0.20^{ns}	-0.127	0.56^{ns}	-0.215	0.31^{ns}
Marital Status	0.217	0.49^{ns}	0.215	0.52^{ns}	0.266	0.40^{ns}
Source of Income	0.000	0.85^{ns}	-0.001	0.71^{ns}	-0.001	0.69^{ns}
Educational Attainment	-0.017	0.82^{ns}	-0.005	0.95^{ns}	-0.017	0.83^{ns}
Tenurial Status	-0.112	0.17^{ns}	-0.096	0.27^{ns}	-0.067	0.41^{ns}
Total Land Area	-0.016	0.94^{ns}	0.072	0.75^{ns}	0.066	0.71^{ns}
Total Land Area Planted with Cacao	0.162	0.46^{ns}	0.099	0.68^{ns}	0.071	0.75^{ns}
Type of Farming Business	0.001	0.10^{ns}	-0.066	0.66^{ns}	-0.079	0.58^{ns}
Source of Capital	-0.010	0.62^{ns}	-0.027	0.23^{ns}	-0.018	0.41^{ns}

* = significant, ns = not significant

Findings revealed that the variable "manual weeding" has the highest positive correlation coefficients among the explanatory variables listed, with correlation coefficients ranging from (r= to 2.862) in 2019, 2020 (r=2.787), and (r=2.617) in 2021, respectively. Interestingly, these correlation coefficients are statistically significant between the “manual weeding" and profitability of cacao production at the 0.05% level during 2019 and 2020, whereas the relationship is not statistically significant during 2021 (Table 11).

Table 11. Correlation analysis on the level of knowledge of cacao farmers and return on investment from 2019-2021 in the selected areas in Misamis Oriental

VARIABLES	2019		2020		2021	
	Correlation Coeff.	Sig.	Correlation Coeff.	Sig.	Correlation Coeff.	Sig.
Years Engaged in Cacao Farming	0.393	0.07^{ns}	0.391	0.07^{ns}	0.379	0.08^{ns}
No. of Training Attended	-0.010	0.93^{ns}	-0.005	0.96^{ns}	-0.006	0.96^{ns}
Soil Fertility Preservation	-0.026	0.08^{ns}	-0.028	0.06^{ns}	-0.031	0.03*
Manual Weeding	2.862	0.04*	2.787	0.05*	2.617	0.06^{ns}
Type of Pesticide	-0.104	0.15^{ns}	-0.075	0.30^{ns}	-0.032	0.65^{ns}
Biological Approach	0.177	0.03*	0.176	0.04*	0.170	0.04*
Sack of Fertilizer	0.057	0.20^{ns}	0.060	0.18^{ns}	0.052	0.24^{ns}
Type of Fertilizer	0.171	0.25^{ns}	0.187	0.21^{ns}	0.194	0.20^{ns}
Grams of Fertilizer Applied per Plant	0.247	0.10^{ns}	0.238	0.11^{ns}	0.219	0.14^{ns}
No. of Days Applying Fertilizer	-0.374	0.17^{ns}	-0.386	0.18^{ns}	-0.352	0.20^{ns}
Packaging Materials were Used	0.171	0.17^{ns}	0.151	0.228^{ns}	0.116	0.35^{ns}
No. of Harvester per Year	-1.142	0.14^{ns}	-0.791	0.30^{ns}	-0.957	0.22^{ns}
No. of Days Finished in Harvesting Cacao	2.114	0.07^{ns}	1.961	0.09^{ns}	1.873	0.10^{ns}

* = significant, ns = not significant

On the other hand, the variable "sack of fertilizer” has the lowest positive correlation coefficients among the variables listed, with correlation coefficients ranging from (r= 0.057) in 2019, 2020 (r=0.060), and 2021 (r=0.052), respectively. However, these correlation coefficients are not statistical, which means that there is not enough evidence to support a meaningful relationship between this variable and the profitability of cacao production. All other variables are positively related to profitability except (r=-0.010) in 2019, 2020 (r=-0.005), and (r=-0.006) in 2021 “no. of training attended," “soil fertility

preservation" (r=-0.026) 2019, (r=-0.028) 2020, (r=-0.031) in 2021, (r= -0.104) 2019, (r=-0.075) 2020, (-0.032) in 2021, "no. of days applying fertilizer" with (r=-0.374) in 2019, (r=-0.386) in 2020, and (r=-0.352) in 2021, and "no. of harvester per year" with (r=-1.142) in 2019, (r=-0.791) in 2020, and (r=-0.957) in 2021 respectively but the relationship of all explanatory variables with profitability were not statistically significant.

It is possible that the level of knowledge of cacao farmers is not significant in predicting return on investment in cacao farming, whereas other variables such as "manual weeding," "biological approach," and "soil fertility preservation" are significant for three (3) years (2019–2021). This is because several factors, including farmer expertise, can affect the profitability of cacao farming. The return on investment can also be significantly impacted by additional variables such as farming techniques, inputs used, market prices, and environmental circumstances.

Discussion

According to Danso-Abbeam *et al*. (2014), the results generally indicated that the sex of the farmer, age of the farmer, household size, educational attainment, mean age of cocoa farms, farm size, and farmer's previous output are all essential variables in explaining farmers' decision to invest in agrochemicals. Most of the cacao farms in the country are small holdings and are owned and managed by farmers (Department of Agriculture and Department of Trade and Industry, 2018). Socio-demographic factors may have some influence on return on investment in cacao farming, they are just one of many factors that can impact financial performance, and their importance will depend on the specific context and factors at play (Jemal *et al*., 2021).

Profitability is higher in the third year as net income doubles relative to the production cost (Department of Agriculture and Department of Trade and Industry, 2018). The high profitability of the product also ensures good income augmentation potentials (Department of Agriculture and Department of Trade and Industry, 2018). Cacao farming income can be influenced by various factors such as geography, climate, access to markets, infrastructure, and government policies. For example, some areas may have more favorable growing conditions for cacao, such as suitable soils, consistent rainfall, and optimal temperature ranges. These areas may produce higher yields and better-quality cacao, resulting in higher prices and, ultimately, higher incomes for farmers (Thorndike and Akrofi, 2016). Given the range of factors that can influence cacao farming income, there could be a significant difference in income between different areas,

and a difference of Php 50,000 or more is certainly possible. It shows that cocoa production is profitable in the study area (Osarenren *et al*., 2016).

According to Agad and Cruz (2014), less hired labor is expected because 85% of the farmer respondents use family members to provide farm hands, especially during the peak production season. At present, the private sector and non-government organizations such as Kennemer Foods International are also providing technical interventions to cacao farmers across the country (Department of Agriculture and Department of Trade and Industry, 2018). Cacao farmers need to manage these factors carefully to ensure optimal yields and high-quality cacao beans (Eke-Okoro, 2017). While demand is on an uptrend, the supply gap continues to widen due to production constraints brought about by factors such as changing weather conditions, pests and diseases, low productivity, aging trees, competing crops, and unsustainable cacao farms (Department of Agriculture and Department of Trade and Industry, 2018).

For instance, the lack of knowledge on Good Agricultural Practices led to improper cacao farm management, thus resulting in low yield and vulnerability of the plant to pests and diseases (Department of Agriculture and Department of Trade and Industry, 2018).

In such a way, farmers could lower the cost of production as well as improve soil quality because of the presence of organic compounds in the compost (Agad and Cruz, 2014). Farmers should be enlightened on the need to use fertilizer (when required) to enhance their production (Agbeniyi *et al*., 2010). Socio-demographic factors may have some influence on return on investment in cacao farming, they are just one of many factors that can impact financial performance, and their importance will depend on the specific context and factors at play (Jemal *et al*., 2021).

Moreover, some studies have found that farmers' knowledge and adoption of good agricultural practices are positively correlated with higher yields and profitability. However, the relationship between knowledge and return on investment may vary depending on the specific context and circumstances of the farm. Therefore, it is important to consider multiple factors when analyzing the profitability of cacao farming and not rely solely on farmers' level of knowledge (Asare, 2016).

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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