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Status of Cacao (*Theobroma cacao* L.) production on its challenges and prospect in Zamboanga del Norte Province in the Philippines

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Abstract Examining the status of cacao production, challenges, and prospects of cacao farmers in Zamboanga del Sur province were done in this study. The investigation revealed that cacao farming was practiced by males (244 or 65.10%) and female cacao farmers (34%) who are primarily married with secondary educational backgrounds. Most cacao farmers were their productive age ranging from 50-59 years old (42.93%), 40-49 years old (34.4%). However, fewer young people engaged in cacao farming aged below 40 years old (7.46%). The primary occupation of the respondents was farming (86.13%), tilling their owned land (84.53%), and with an average annual income below 60,000 pesos (50.40%). The average farm size was at 1-3 hectares (80.00%), having a plain (40.27%) to rolling topography (47.47%) planted with UF 18 (50.13%) and BR 25 (49.87%) varieties of cacao. Intercropping was observed (99.20%) with coconut (79.20%) and banana (14.67%) planted along with cacao. Pest infestation of stem borer (59.73%) and bugs (22.67%) were observed at a low level (79.20%) and controlled using Lamdacyhalothrin (86.40%) as a chemical spray. Moreover, cacao diseases in farms were at a low incidence level (74.13%), with vascular streak dieback (53.06%) as the most common disease among farms, and the method of controlling the spread was using chemicals (53.60%) and synthetic pesticides (100%) as a spray. Farms established 2 years from sowing (90.13%) observed farm management practices such as weeding twice a year (45.33%), fertilizer application 4 times a year (88.00%) using 1-3 bags per hectare (85.06%). Cacao trees produced 0.50-1.50 (50.00%) of seeds per tree. Cacao products are sold in dried form (60.98%) with prices ranging from 81-100/kilogram through cooperative (100%). Farmers faced numerous challenges, the most significant of which were the high cost of routine maintenance (such as cleaning/brushing) and shortage of laborers. The accessibility from the farm to the market road was also seen as a challenge among them. The province's cacao agricultural stakeholders extended to support services to farmers such as free planting materials, credit assistance, cacao production seminars, and post-harvest facilities, which were all considered valuable to farmers in addressing the challenges they faced on cacao farming and production.

Keywords: Cacao production, *Theobroma cacao* L., Challenges of production, Prospect of cacao production

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Introduction

Theobroma cacao, the scientific name of cacao, literally translates as "food of the gods" in Greek (Bureau of Plant Industry, 2017). Cacao is developing as an important economic development engine in several countries throughout the world. As cocoa beans' supply and demand imbalance widens in recent years, the cacao industry has begun to acquire traction in domestic and international markets, resulting in increased recognition for the industry (Bureau of Plant Industry, 2017). It was projected that by 2020, global cocoa (*Theobroma cacao* L.) demand is anticipated to be between 4.7 and 5 million metric tons (MT), and production capacity would be 1 million MT short. Along with the rising demand for the commodity, cocoa bean output has skyrocketed due to the rapid expansion of small farmer participation. The increase in the global market is a chance for the Philippines to expand its economy and create more jobs. 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). Moreover, Cacao has been listed as one of the vital crops in the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development's Industry Strategic Science and Technology Plans. The goal of the plan is to improve the cocoa business by using scientific and innovative methods.

However, the cocoa business in the Philippines is currently experiencing a resurgence. After it has observed a rise in cocoa production volumes since 2006, the government implemented policy measures to ensure the industry's continued growth through R.A. 7900, also known as the High-Value Crop Development Program Act, emphasizing the intensification of cocoa production as one of its priorities. Additionally, local farmers have increased their interest

in cocoa planting due to the increasing demand for cocoa from both domestic and international markets (Peace and Equity Foundation, 2016).

Considering these opportunities, local farmers, particularly in Zamboanga del Norte, have become more interested because regional and international demand for cocoa products far exceeds the country's production capacity, and world cocoa prices have remained consistently favorable over the past several years.

On the other hand, farmers faced difficulties farming and producing cacao, which was not easy to grow due to potential threats that might attack the cacao trees. According to Junaid (2015), cacao has four primary threated on and off the plantation that must be addressed. These difficulties are characterized by the low yield on cocoa plants, severe pests and diseases, a lack of skills and knowledge of good agricultural practices among farmers, and soil and post-harvest handling management. Aside from the above-cited difficulties, many cocoa farms are increased to old with some in production for more than 25 years (Nabua *et al.*, 2013). Furthermore, cocoa plantations have been severely affected by pests and diseases (Marelli *et al*., 2019), with cocoa pests such as cocoa pod borer and fruit suckers being particularly problematic (Helopelthissp.), as well as cocoa diseases such as black pod disease vascular streak dieback, known as vsd.

Moreover, smallholder cocoa producers are believed to be more likely than larger-scale cocoa growers to lack the necessary skills and understanding of appropriate agricultural techniques. The number of minerals in farms where cocoa crops are planted to be dwindling, and many farms lack post-harvest processing. The combination of these factors posed a serious challenge to cocoa production. Considering these factors, cacao may find itself in a weaker bargaining position than other crops such as palm oil, which is boomed at the moment, and corn (Junaid, 2015).

Cacao growers face several issues because of those mentioned above, prompting research to identify potential remedies. There may be a way to reach this goal by conducting a comprehensive investigation of cacao production at a provincial level. This study should look at everything from labor costs and returns to the expanding potential and prospects for cacao production that come from it. It is imperative that research for this area needs urgency to make decisive actions to address the need of cacao farmers.

The findings of this study was to serve as a valuable source of reliable information about the cacao production status, compelling challenges encountered, and prospects of cacao farmers in Zamboanga del Norte; information that would be assisted cacao farmers, traders, government, and private sectors in the Zamboanga Peninsula.

Materials and methods

The researchers utilized a descriptive-quantitative survey research approach to collect data on the status of cacao production, its challenges, and prospects in the province of Zamboanga del Norte. A total of 13 municipalities and 1 city were selected as the site for this study where high cacao production is evident.

The respondents of this study were chosen purposively among the cacao farmers of selected municipalities of Zamboanga del Norte who had at least 50 and above cacao trees in the production stage. In the first district, which covers Dapitan City, Polanco, Piñan, and Mutia, there were 111 respondents in the second district, municipalities of Roxas, Jose Dalman, Manukan, Sindangan, and Siayan with 98 respondents and in the third district which included municipalities of Liloy, Tampilisan, Gulatac, Baliguian, and Siocon 166 respondents were chosen. A total of 375 cacao farmers in the province participated in this study.

The researcher used a survey questionnaire checklist as the main instrument in gathering needed data from the respondents. The questionnaire checklist consisted of the following parts: Part 1, Socio-demographic Profile of the Respondent; Part 2, Status of Cacao Production Part 3, Challenges Encountered by the respondent; Part 4, Prospects and suggested solutions of cacao farmers in the Province of Zamboanga del Norte.

The researchers made sure that the data gathering conformed with ethical standards in conducting survey research. The data gathering started in November 2018 and ended in March 2019.

After retrieving all the completed questionnaire checklists from the respondents, total responses for each item were consolidated and tabulated. The results were analyzed using descriptive statistics such as frequency counts, percentages, and ranked respectively.

Results

A four-dimensional discussion was presented the findings of this study, namely; 1) Descriptive analysis of the profile of the cacao farmers in Zamboanga del Norte province in the Philippines; 2) Descriptive analysis of the status of cacao production in Zamboanga del Norte province in the Philippines; 3) Descriptive analysis of the challenges in cacao farming encountered by the cacao farmers; 4) Descriptive analysis on the prospects and suggested solutions of farmers for the cacao production.

Descriptive analysis of the profile of the cacao farmers in Zamboanga del Norte province in the Philippines

The profile of cacao farmers in terms of sex, civil status, age, religion, and educational attainment is presented in Table 1. Most of the cacao-farmer respondents in the province of Zamboanga del Norte were males, with 244 or 65.10%, while the remaining 131 or 34% were females. These data showed that males mainly venture to farm. However, females were also engaged in farming endeavors.

Most of the cacao-farmers respondents are married with 342 or 91.2%, single with 17 or 4.53%, a widow with 14 or 3.73%, and separated with 2 or 0.53%. It showed that married persons were to do farming activities to augment their income for their basic needs.

As to the age of the farmer-respondent, 161 or 42.93% were 50-59 years old, 129 or 34.4% were 40-49 years old, and 48 or 12.8%, 28 or 7.46 were 60 years old and above, and 30-39 years old, respectively. It showed that most farmers who had interested in cacao farming were 50-59 years old.

Their religious affiliation of 325 or 86.67% were Roman Catholic, 16 or 4.27% Alliance and 16 or 4.27% SDA, 9 or 2.40% UCCP, 7 or 1.87% Iglesia ni Cristo, and 2 or 0.53% Islam. Generally, Roman Catholic is the dominant. 23 religions of the cacao farmers in Zamboanga del Norte.

Regarding their educational attainment, 145 or 38.66% were high school level, 124 or 33.06% elementary level; 64 or 17.06% college level; 40 or 10.56% were professionals and 2 or 0.53% with no schooling. This implies that most farmer-respondents obtained a high school level of their education.

The profile of cacao farmers in terms of the main occupation, the number of family members and membership in the organization, land tenure status, and average family annual income of the respondents is presented in Table 2. Out of the 375 respondents, 323 or 86. 13% were in farming, 30 or 8% were in Business, 15 or 4% were government employees, and the remaining 7 or 1.87% were private employees. This attests that farming was the dominant occupation of cacao farmers in Zamboanga del Norte. Regarding the number of family members recorded that 206 or 54.93% had 1-3 families members, 129 or 34.40%, 40 or 10.68% had 4-6 and 7-9 members, respectively.

In terms of membership in an organization, 274 or 73% members of farmer's cooperative and 101 or 26.93% were in the farmers' association. This implies that all cacao farmers were members of specific organizations, making them more attractive to prospective buyers and consequently demanding a higher price. As to the tenurial land status, 317 or 84.53% were the owner

cultivators; 31 or 8.26% were land transfer beneficiaries, and 27 or 7.20 were tenants. This implies that most of the cacao farmers were landowners.

Table 1. Profile of cacao farmers in terms of gender, civil status, age, religion, and educational attainment

Variable	F	Percentage %
Gender		
Male	244	65.10
Female	131	34.90
Total	**375**	**100.00**
Civil Status		
Single	17	4.53
Married	342	91.20
Widow	14	3.73
Separated	2	0.53
Total	**375**	**100.00**
Age		
60 above	48	12.80
50-59 yrs old	161	42.93
40-49 yrs old	129	34.40
30-39 yrs old	28	7.46
Total	**375**	**100.00**
Religion		
Alliance	16	4.27
UCCP	9	2.40
Iglesia ni Cristo	7	1.87
SDA	16	4.27
Roman Catholic	325	86.67
Islam	2	0.53
Total	**375**	**100.00**
Educational Attainment		
No Schooling	2	0.53
Elementary level	124	33.06
High School level	145	38.66
College Level	64	17.06
Professionals	40	10.66
Total	**375**	**100.00**

About their averaged family annual income, 189 or 50.40% had income below 60,000 pesos, 77 or 20.53% with P60,000-120,000, 52 or 13. 86% P120,000-180,000, 26 or 6.93% P180, 000-240,000; 21 or 5.60% 26 240,000-300,000; and 10 or 2.67% 300,000 and above annual income, respectively. This means that most of the farmers engaged in cacao farming were in hand to mouth existence who are merely depended on their farm's given inputs.

Table 2. Profile of the cacao farmers in terms of the main occupation, number of family members, membership organization, land tenurial status, average family annual income of the respondents

Variable	F	Percentage (%)
Main Occupation		
Farming	323	86.13
Business	30	8.00
Gov't Employee	15	4.00
Private Employee	7	1.87
Total	**375**	**100.00**
Number of Family Members		
1-3	206	54.93
4-6	129	34.40
7-9	40	10.68
Total	**375**	**100.00**
Membership Organization		
Farmers Association	101	26.93
Farmers' Cooperative	274	73.07
Total	**375**	**100.00**
Land Tenurial Status		
Owner	317	84.53
Tenant	27	7.20
Land Transfer Beneficiary	31	8.26
Total	**375**	**100.00**
Average Family Annual Income		
Below 60,000	189	50.40
60,000-120,000	77	20.53
120-180,000	52	13.86
180-240,000	26	6.93
240-300,000	21	5.60
300 and above	10	2.67
Total	**375**	**100.00**

Descriptive analysis of the status of cacao production in Zamboanga del Norte province in the Philippines

Cacao farm size, topography, frequency of soil analysis, clone planted, and planting distance

The status of cacao production in Zamboanga del Norte in terms of cacao farm size, topography, frequency of soil analysis, clone planted, and planting distance is shown in Table 3.

For the cacao farm size, out of 375 respondents, 300 or 80% had farm size of 1.0-3.0 hectares of cacao farm, 67 or 17.87% with less than one hectare, 5 or 1.33% with 4.0-6.0 hectare, 2 or 0.53% with 7.0-9.0 hectare, 1 or 0.27%

10.0 hectare and above. This implies that most of the farm sizes utilized for cacao production were small-scale 1.0 to 3.0 hectare, considering the cost of production.

The most common topography of used farms was rolling with 178 or 47.47% followed by 151 or 40.27% plain topography, and 46 or 12.27% was hilly. As of the frequency of soil analysis, 272 or 73.07% did not practice soil analysis in their cacao farm, while the 101 or 26.93% practice soil analysis at least once a year. This implies that the majority of farmers were not aware of the value of soil analysis. Regarding the cacao varieties or clone are planted, the most popular was BR 25 and UF 18, with 53. 13 and 49.87 % comprising the 100% percent of planted cacao in the province. All respondents used the recommended planting distance of 3X3 square method with 375 or 100%.

Table 3. Status of Cacao production in terms of Cacao farm size, topography, frequency of soil analysis, clone planted and planting distance

Variable	F	Percentage (%)
Cacao Farm Size (ha)		
Less than 1	67	17.87
1.0-3.0	300	80.00
4.0-6.0	5	1.33
7.0-9.0	2	0.53
10.0 and above	1	0.27
Total	**375**	**100.00**
Topography		
Plain	151	40.27
Rolling	178	47.47
Hilly	46	12.27
Total	**375**	**100.00**
Frequency of soil analysis		
None	274	73.07
Once a year	101	26.93
Total	**375**	**100.00**
Varieties/Clone planted		
UF 18	188	50.13
BR 25	187	49.87
Total	**375**	**100.00**
Planting distance in meters		
3 x 3	375	100.00
Total	**375**	**100.00**

Kinds of intercrop planted, the farming system employed, common cacao insect pest observed, degree of insect pest infestation, and kind of applied chemical

The status of cacao production in Zamboanga del Norte in terms of kinds of intercrop, the farming system employed, common cacao insect pest observed, degree of insect pest infestation, and the kind of chemical applied in

the farm is presented in Table 4. As for the types of intercrop planted, coconut was the most widely used intercrops with 297 or 79.20%, 55 or 14.67 % banana, 14 or 3.73% planted fruit trees, and 9 or 2.40% used rubber plant for their intercrops. 372 or 99.2% used intercropping while 3 or 0.8% practice monocropping.

The most observed insects in their farm were stem borer with 224 or 59.73%, 85 or 22.67% were bugs, 33 or 8.80% cacao pod borer, termites, and thrips with 19 or 5.07%, and 14 or 3.73%, respectively. In terms of the degree of insect infestation, the highest-rated scale was low with 297 or 79.2%, very low with 72 or 19.2% and 6 or 1.6% rated the high scale of infestation. For the kind of applied chemical, 324 or 86.40% used lamdacyhalothrin (karate, Y-kurat), 44 or 11.73% cypermethrin (cymbush or magnum, etc), and 7 or 1.87% used cartap hydroxide (blizzard, star cartap and leap cartap).

Table 4. Status of cacao production in terms of kinds of intercrop planted, farming system employed, common cacao insect pest observed, degree of insect pest infestation and kind of chemical applied

Variable	F	Percentage (%)
Kinds of intercrops planted		
Rubber	9	2.40
Coconut	297	79.20
Banana	55	14.67
Fruit trees	14	3.73
Total	**375**	**100.00**
Farming system employed		
Monocroping	3	0.80
Intercropping	372	99.20
Total	**375**	**100.00**
Common cacao insect pest observed		
Cacao pod borer	33	8.80
Stem borer	224	59.73
Bugs	85	22.67
Thrips	14	3.73
Termite	19	5.07
Total	**375**	**100.00**
Degree of insect infestation		
Very low	72	19.20
Low	297	79.20
High	6	1.60
Total	**375**	**100.00**
If using chemical control, kind of chemical applied cypermethrin (cymbush, magnum, etc.)	44	11.73
Cartap Hydroxide (blizzard, star cartap, leap cartap)	7	1.87
Lamdacyhalothrin (karate, Y- Kurat)	324	86.40
Total	**382**	**100.00**

Common cacao diseases observed, degree of disease incidence, method of pest control, kind of pesticide used and the frequency of pesticide application

The common cacao diseases were observed by the respondents, 199 or 53.06% was vascular streak dieback, 105 or 28% cacao pod rot, stem canker disease with 71 or 18.93%, 278 or 74.13% low scale of disease incidence, 93 or 24.80% with very low, 3 or 0.80% high scale, and 1 or 0.27% very high scale.

In terms of the method of pest control, the use of the chemical was the most frequent remedy with 201 or 53.60%, 174 or 46.40% used cultural method.

As for the frequency of synthetic pesticide application, 356 or 94.93% followed the recommended rate of 14 days intervals while 19 or 5.07% when the need is arised.

Table 5. Status of cacao production in terms of common cacao diseases observed, degree of disease incidence, method of pest control, kind of pesticide used, and the frequency of pesticide application

Variable	F	Percentage (%)
Common cacao diseases observed		
Cacao pod rot	105	28.00
Vascular streak Dieback	199	53.06
Stem canker	71	18.93
Total	**375**	**100.00**
Degree of disease incidence		
Very low	93	24.80
Low	278	74.13
High	3	0.80
Very High	1	0.27
Total	**375**	**100.00**
Method of pest control		
Cultural	174	46.40
Chemical	201	53.60
Total	**375**	**100.00**
Kinds of pesticide used		
Organic	0	0.00
Synthetic	375	100.00
Total	**375**	**100.00**
Frequency of pesticide application		
14 days interval	356	94.93
If the need arises/optional	19	5.07
Total	**375**	**100.00**

Frequency of weeding per year, weeding method adopted, period of farm establishment, frequency of fertilizer application, and volume of fertilizer applied per hectare

The status of cacao production in Zamboanga del Norte in terms of frequency of weeding per year, weeding method adopted, period of farm

establishment, frequency of fertilizer application, and volume of fertilizer applied per hectare is presented in Table 6. For weeding frequency, 170 or 45.33% did weeding twice a year, 114 or 30.40% every quarter, 91 or 24. 27% on a monthly basis. This implies that weeds are properly managed to facilitate the ease of pruning and harvesting. For the farm establishment, 336 or 90.13% is established their farm for 2 years, 33 or 8.80% for 3-5 years, and 4 or 1.07% 6-10 years. In terms of frequency of fertilizer application, 330 or 88% applied fertilizer four times a year, 21 or 5.6%, 18 or 4.8%, 3 or 0.8%, and 3 or 0.8% twice a year, three times a year, once a year, and every month, respectively. With the volume of used fertilizer 319 or 85.07% is used 1-3 bags per hectare, 20 or 5.33% use 4-6 bags per hectare, 19 or 5.06% is used 10 bags, and 17 or 4. 53% is used 7-9 bags per hectare.

Table 6. Status of cacao production in terms of frequency of weeding per year, weeding method adopted, period of farm establishment, frequency of fertilizer application, and volume of fertilizer applied per hectare

Variable	F	Percentage (%)
Frequency of weeding per year		
Monthly	91	24.27
Every quarter	114	30.40
Twice a year	170	45.33
Total	**375**	**100.00**
Weeding method adapted		
Manual	101	26.93
Combination Man/Chem	135	36.00
Chemical	139	37.07
Total	**375**	**100.00**
Period of farm establishment		
2 years	338	90.13
3-5 years	33	8.80
6-10 years	4	1.07
Total	**375**	**100.00**
Frequency of fertilizer application		
every month	3	0.80
twice a year	21	5.60
3 times a year	18	4.80
4 times a year	330	88.00
Once a year	3	0.80
Total	**375**	**100.00**
Volume of Fertilizer applied per ha		
1-3 bags	319	85.06
4-6 bags	20	5.33
7-9 bags	17	4.53
10 bags	19	5.06
Total	**375**	**100.00**

Product sold, cacao farm gate price per kilo, system of marketing, and volume of production per tree per year

The status of cacao production in Zamboanga del Norte in terms of cacao product sold, cacao farm gate price per kilo, marketing system, and volume of production per tree per year are presented in Table 7. The respondents indicated more than one type of product sold with 224 or 59.73 % dispose of dried beans, 139 or 3.07 % wet beans, and 12 or 3.20 % fermented beans. As to the selling price, the respondents sold their beans at 81.00-100.00 pesos per kilogram and directly marketed through the cooperative with 375 or 100% of the respondents indicated as to the volume of production per tree per year, 190 or 50.67% produce 0.5-1.5 kg per tree per year, 93 or 24.80% with 1.6-2.5 kg per tree per year, and 92 or 24.53% with 2.6-3.5 kg per tree per year.

Table 7. Status of cacao production in terms of product sold, cacao farm gate price per kilo, system of marketing, and volume of production per tree per year

Variable	F	Percentage (%)
Product sold		
Wet	139	37.07
Fermented	12	3.20
Dried	224	59.73
Total	**375**	**100.00**
Cacao farm gate price per kilo		
PHP 81-100	375	100.00
Total	**375**	**100.00**
System of marketing		
Through the cooperative	375	100.00
Total	**375**	**100.00**
Volume of production per tree per year (kg)		
0.5-1.5	190	50.67
1.6-2.5	93	24.80
2.6-3.5	92	24.53
Total	**375**	**100.00**

Descriptive analysis of the challenges in cacao farming encountered by the cacao farmers

Challenges encountered by cacao farmers

The challenges encountered by cacao farmers-respondents in Zamboanga del Norte is presented in Table 8. The data showed that the cost of maintenance like cleaning/brushing and lack of laborers as rank 1 with both 232 respondents, farm to market road as rank 3 with 184; rank 4 technical knowledge, rank 5 post-harvest facilities, rank 6 cost of farm inputs like fertilizers and chemicals, stealing of pods as rank 7, presence of stray animals in the plantation, high degree of disease incidence, supplier of quality planting materials and low

production yield as rank 8,9,10 and 11, respectively, transportation cost, absence of cacao technicians, peace and order situation, and the distance of the cacao plantation to market as rank 12, 13 and 14, and rank 15.

Table 8. Challenges encountered of cacao farmers in Zamboanga del Norte Province in the Philippines

Variable	F	Rank
Cost of maintenance like cleaning/brushing	232	1.5
Lack of laborers	232	1.5
Farm to market road	184	3
Technical knowledge	100	4
Post-harvest facilities	96	5
Cost of farm inputs like fertilizers and chemicals	84	6
Stealing of pods	39	7
Presence of stray animals in the plantation	37	8
High degree of disease incidence	31	9
Supplier of quality planting materials	26	10.5
Low production/yield	26	10.5
Transportation cost	20	12
Absence of cacao technicians	13	13
Peace and order situation	11	14
Distance of the cacao plantation to the market center	10	15
Market outlet	3	17
Price Fluctuation	3	17
Information campaign conducted by authorities	3	17

Descriptive analysis on the prospects and suggested solutions of farmers for the cacao production

Prospects of farmers for their cacao production

The potential areas planted with cacao by the farmers in the province of Zamboanga del Norte is presented in Table 9. Farmers indicated that they were targeting to plant more cacao. The vacant area potential for planting cacao ranged from 1-3 hectares as rank 1 with 333 or 88% and 3-6 hectares as rank 2 or 7.73%. However, some farmers indicated none.

Table 9. Potential areas that can be planted with cacao

Variable	F	Rank
1-3 ha	333	1
3-6 ha	29	2
None	13	3

Support services extended by the Department of Agriculture, Local Government Unit and non-government units

The support services extended by the Department of Agriculture, Local Government Unit, and non-government units are as follows: free planting

materials, credit assistance, seminar on cacao production as rank 1, 2, and 3, post-harvest facilities as rank 4, technical assistance as rank 5, organized as cooperative as rank 6, price support as rank 7, market linkages as rank 8, and farm to market road as rank 9 as seen in Table 10.

Table 10. Support services extended by the Department of Agriculture, Local Government, and non-government organization

Variable	F	Rank
Free planting materials	304	1
Credit assistance	242	2
Conducted seminar on cacao production	100	3
Post-harvest facilities	99	4
Technical assistance	81	5
to demand a good price	69	6
Price support	45	7
Market linkages	34	8.5
Farm to Market Road	34	8.5
Organized them into cooperative		

Suggested solution of farmers to increase cacao production in Zamboanga del Norte province in the Philippines

The suggested solutions by the cacao farmer-respondents for the challenges encountered is shown in Table 11. The data revealed that free planting materials and farm inputs as rank 1, seminar on pest awareness, post-harvest facilities assistance, presence of cacao experts, farmers training, and farm supervision as rank 2, 3, 4, and 5, respectively, technical assistance as rank 6, price stability as rank 7, and guaranteed market outlet and price as rank 8. This implies that the farmers needed assistance on planting materials and farm inputs such as fertilizer and other chemical inputs for more cacao production.

Table 11. Suggested solution of farmers to increase cacao production

Variable	F	Rank
Free planting materials and farm inputs	187	1
Seminar on pest awareness	113	2
Post-harvest facilities assistance	112	3
Presence of cacao Doctors	109	4
Farmer's training and supervision	85	5
Technical assistance	84	6
Price stability	41	7
Guaranteed Market Outlet/Price	36	8

Discussion

Cacao has become a priority high valued crop in the Philippines because of the increased market demand and persistently favorable prices. The Philippines, with its cocoa bean production capacity, may benefit from rising

worldwide demand and the need for new players in the value chain (DTI, 2017). This study aimed to establish baseline data for the cacao production status, challenges encountered, and prospects of cacao farmers in Zamboanga del Norte.

Given that older people tended to stay in villages while younger people tended to go into cities for education, trade training, and the pursuit of white-collar employment, a more significant percentage of cacao farmers are fallen into the older age group above 50 years old with educated at the secondary level. The demographic profile of farmers' results corroborated with several studies, which showed that farmers were primarily old age and with low educational backgrounds. The majority were married (Lirag, 2021; Villaver *et al*., 2021; Yaw *et al*., 2001). Moreover, this industry in the province is dominated by males. Nonetheless, in farming, gender difference had no significantly affected on the cacao plantation establishment and management (Valleser *et al*., 2020a) and coffee production (Ngeywo *et al*., 2015).

Furthermore, many cocoa farmers (54.93%) were from families with 1-3 individuals, and most of them were members of a farmers' cooperative. By implication, it is a reasonable assumption that cacao farmers were collaborated with other cacao farmers to share their knowledge and experiences in cacao production.

Farmers' principal source of income come from the selling of cocoa beans, with many of them receiving an annual income of 60,000 pesos or less per year on their farms. The result is consistent with Peprah (2015), who reported that farmers gained cash from selling cocoa beans and used to support the farming family's ongoing sustenance. With the low income generated, it is understood that cacao farmers have started in the cocoa industry with limited financial resources, resulting in financial loans. On the other hand, Cacao farmers had an advantage over other crop farmers since they owned the land they cultivated, unlike corn farmers, who were primarily tenants (Villaver *et al.*, 2021). Moreover, it was found that cacao farmers who owned the land they cultivated perform well compared to plantations maintained by tenants and employees (Valleser *et al.*, 2020b).

Most farmers have farmed cacao in an area of 1.0-3.0 hectares of land for cacao production. The same result was seen among cacao farmers in Camarines Sur province in the Philippines (Lirag, 2021). BR25 and UF18 cacao were the most commonly planted cacao kinds among Zamboanga del Norte farmers because of this attribute. Valleser and colleagues (2020) described BR25 and UF18 cacao cultivars with good yields and tolerance to harsh conditions like brighter light. Cacao farmers have also employed a 3 x 3 square meter approach to correct planting distances.

Moreover, the planted land is characterized mainly by rolling topography. A similar study postulated that cacao farms in the Philippines consisted of rugged topography (Nabua *et al*., 2013). Farmers practiced intercropping almost

exclusively (99.2% of the time). In the intercrop farming system, coconut was the most planted, along with cacao and banana. The intercropping farming system was practiced across all cacao farmers in the province. The method of intercrop, in particular, was attributed to four reasons by Javier (2015) why coconut has continued to be the Philippines' leading industrial perennial crop. One of these reasons is the potential to maximize the amount of sunshine that filters through the trees by planting intercrops of annuals and perennials. Intensive double canopy farming generates extra employment, increases food production, lowers food prices for everyone, and provides additional money to coconut farmers, frequently exceeding the revenue generated.

In this study, common pests in cocoa were identified. Stem borers are the most common pest encountered by cacao farmers in the province, followed by bugs and cacao pod borer. Similar study in Côte d'Ivoire, West Africa also discovered that stem borer are the main pest that attack cacao plants (Balineau *et al.,* 2016). However, in Zamboanga del Norte province, pests infestation was managed using chemical pesticides by spray application, mainly lamdacyhalothrin (karate,Y-kurat). In Africa, pest control and eradication were done by spraying and boosting cacao production in the area (Nnaji, 2011). There were cacao plant diseases identified by the farmers presented in their plants. Vascular streak dieback *(Ceratobasidium theobromae)* was identified as the primary disease in cacao farms in the province, followed by cacao pod rot. According to McMahon & Purwantara (2016c), vascular streak dieback is one of the most devastating cacao disease endemic in the Southeast Asian/Melanesian region, causing branch dieback and infections capable of killing seedlings and mature cacao trees. Nonetheless, farmers in the province controlled and managed this cacao disease using the chemical spray at 14 days intervals as recommended.

Farmers in the province also practiced manual, chemical, or combination of both weeding methods twice a year. The cacao farms in Zamboanga del Norte were almost all (90.13%) cacao farms were established two years ago, and most of them (88%) applied fertilizer four times a year. Almost all farmers used 1-3 bags of fertilizer per hectare. Cacao is a type of tree that grows year after year. Observations from the province showed that cacao growers did not make regular weekly visiting their farms, even though the crop had began producing pods for two years after field transplanting (Valleser *et al.,* 2020c). The respondents indicated more than one type of product sold, but the most market is dried (59.73%) at P81.00-100.00 pesos per kilo. This result was further supported by Lirag (2021) that cacao beans sold at Php 85.00 per kilo of dried cacao beans. However, the price could increase by Php 100.00 to Php 150.00, if the beans are sorted before being sold. Many of the respondents produced 0.5-1.5 kg per tree per year.

Activities such as pruning, sowing seeds, and other related activities were seen as an essential part of growing cacao (Valleser *et al.,* 2020a). These

activities were the challenges among farmers in Zamboanga del Norte Province. Cost of maintenance like cleaning/brushing/pruning and lack of laborers were the significant challenges which encountered by cacao farmers. Additionally, farm-to-market road, technical knowledge, post-harvest facilities, and cost of farm inputs like fertilizers and chemicals also contributed to cacao farmers' challenges. Farmers are also identified an area of 1-3 hectares potential for planting cacao trees.

However, farmers from the province received support from the Department of Agriculture, the Local Government Unit, and Non-Governmental Organizations. The most common services offered to farmers were free planting materials, credit assistance, conducted seminars on cacao production, and post-harvest facilities for processing cacao products. These activities and support are concerned a way to offers opportunity for farmers to engage in cacao farming and productivity (Vadnjal and Pelomo, 2014).

The solution to problems and challenges identified by cacao farmers to sustain their farms are continued provision of cacao planting materials and farm inputs. Seminars on pest identification and control, post-harvest facilities assistance, and farmers' training can also boost productivity. Farmers understood the presence of cacao experts to guide them in cacao farming as an essential aspect in growing and cultivating cacao.

The study concluded that cacao farming in Zamboanga del Norte province was a nascent industry requiring relevant stakeholders' support. The presence of supportive organizations to farmers ensured that the industry of cacao production would thrive in the years to come. As the cacao industry progressed, several technologies were already developed; thus, problems in cacao farming, growing practices, and farm management was less likely seen as a burden to farmers in Zamboanga del Norte. Nonetheless, farm maintenance was one of the critical factors which burden cacao farmers in sustaining their farms as they are mainly earned from selling cacao seeds. Although cacao seed was reasonably priced in the province, farmers' output was still low because their cocoa trees were in the growth stage and were aged two years or younger. Farmers used intercropping practices extensively, with coconut and cacao being the most planted crops in their farms. However, post-harvest processing to add value to cacao produce was needed by farmers as this would increase their potential profit from cacao farming instead of selling cacao seed after harvest. Moreover, the province has the potential for cacao production as it indicated that most cacao farmers had 1 to 3 hectares of land. Substantial knowledge on cacao farming, reasonable price for cacao products, and the support system for farmers will lead to a long-term impact on the cacao industry in the province of Zamboanga del Norte.

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