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IMPACT OF COCONUT PRODUCTION ON THE ENVIRONMENT AND THE PROBLEMS FACED BY COCONUT PRODUCERS IN LANAO DEL NORTE PROVINCE, PHILIPPINES

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Abstract

Environmental impacts of coconut production may be both positive and negative. Coconut may have a lesser impact on the environment. However, its negative impact may influence the coconut farming of the farmers overwhelmingly. The study was carried out in Lanao del Norte Province in the Philippines from October to November 2016. It was selected purposively for the reason that the majority of the farming activities is from coconut farming particularly in smallholding farming. A total of 400 respondents were interviewed using closed-ended questionnaires. It was felt necessary to identify the impact of coconut production on the environment, the internal and external faced by coconut producers, the factors influencing the coconut yield, and the practices on coconut productions by coconut producers. The study revealed that the severe problems encountered by the coconut producers on coconut production for internal problems were the far distance of the land from farm to market road, intercropping, high cost of laborers, and low and fluctuating price of coconut product for the apparent problems. Furthermore, issues such as pests and diseases, difficulties in nut collections, high transportation expenses in marketing problem, and government taxes for the obvious question were found as severe problems. The regression results revealed that the educational Attainment, size of the land (in hectare), number of coconut tree planted per hectare, the distance of the property from the market road, and the frequency of harvesting nut have a strong influence on coconut production.

Key words**:** *coconut, coconut production, environmental impact, coconut producer, crop, Philippines*

INTRODUCTION

Coconut is a fruit that grows on a coconut tree. It is the seed of the coconut tree. The coconut got its name in the 16th century from the word ‘coco' which means ‘monkey face' [18]. Coconut (*Cocos nucifera* L.) is a monocot belonging to the family *Arecaceae,* subfamily *Cocoideae* and is the sole species of the genus *Cocos* [19]. There are only two significant classifications of coconut such as tall and dwarf [7].

Coconut is one of the most useful palms in the world; every part of the coconut tree has its usefulness. Coconut provides almost of the basic needs of humankind such as food, shelter, medicines, fuel, drink, furniture, decorative materials, cosmetics, and many others. Hence, it is popularly known as "Tree of Life," from the roots to the leaves of the tree are potential raw materials for almost everything [8].

The coconut was introduced in the Philippines by immigrants from the Indo-Malayan archipelago in the early twelfth and thirteenth centuries [10]. Coconut is a smallholders' crop, and a significant proportion of the production is usually consumed locally. Since the Spanish colonialism, coconut serves as the top agricultural crop produced and used as foods by the native Filipinos. Coconut symbolizes the farming life of the Filipino farmers were over 3.5 million coconut producers depend on coconut farming directly or indirectly [8]. The importance of coconut has been surprisingly vital where coconut industry employs more than 3 million coconut producers and workers and to 25 million more

Filipinos working in various coconut-based enterprises throughout the country [17].

Coconut is one of the most important crops grown in more than 93 countries in the world where the main coconut growing areas are located in Asia, Oceania, West Indies, Central and South America and West and East Africa [19]. It is in fact that these countries are dependent on the coconut to some degree either as a source of nutrition, employment, and economic contributor or many times all combined [6]. Philippine is the second largest producer and exporter of coconut all around the world. According to the Philippine Coconut Authority (PCA), 68 out of 81 provinces of the country are coconut areas having 3.517 Million hectares planted to coconut covering about 26 percent of agricultural land and producing 14.902 billion nuts per year [2]. In 2016, coconut areas planted to coconut increased to 1.35% or 3.565 Million hectares [4]. In Northern Mindanao, Region 10, coconut farming is one of the significant sources of income of the coconut producers where it has a share of 12.25 % of the total coconut production in the Philippines [4].

However, trends in coconut production are decreasing due to several factors. Consequently, coconut producers are at a significant disadvantage. They are the producers, but they have the least power over their products. The traders and the processors mostly benefit from the local coconut market profit. Moreover, government policies concerning the industry serve the interest of the powerful exporter processor more than those of the farmers [10]. Despite being part of a multi-billion dollar industry, coconut producer is among the poorest in the Philippines with 60% living at or below the poverty line of 20,000₱ (US$444) per year [1].

On the other hand, several factors have been affecting the farming of coconut producers in coconut production, particularly in the province of Lanao del Norte in Northern Mindanao. The farmers are the poorest within the Philippine agricultural sector and their limited resources, low social protection, low income and limited influence in the network, are slowing down the development of the industry at large. These factors deprived the coconut farming activities of the farmers.

On the other hand, cultivating coconut requires good soil drainage and can adapt to a wide range of soil types [5]. Soil erosion is one of the world's disastrous environmental problems threatening the sustainable development of human beings, particularly the agricultural farming activities of the farmers [24]. One of the surprising importance's of coconut production especially in the production of coconut coir is that it helps restore Mother Nature's beauty and vigor by rehabilitating agricultural lands and preventing erosion of topsoil [9]. However, since coconuts require good drainage, it cannot tolerate flooding or waterlogged condition [5].

Hence, it was felt necessary to identify and discuss the impact of coconut production on the environment, the problems encountered by the coconut producers to understand fully the reasons why despite their significant contribution in the agricultural economy they remain as one of the poorest sectors in the community. The study will also examine the factors influencing the coconut yield of the coconut producer.

MATERIALS AND METHODS

The study was carried out in Northern Mindanao of Philippines particularly in Lanao del Norte Province. The study area was selected purposively for the reason that majority of the farming activities is from coconut farming particularly in smallholding farming and despite the standing of the province in coconut production; the area was reported as one of the poorest regions in the Philippines.

Sampling procedures and sample size

This study involved smallholder coconut producers. In the study area, there was 26,077 total number of coconut producers. It used the stratified random sampling method. Using the stratified random sampling, the populations were divided into three strata based on the

number of districts. Then, the frequencies of each stratum were identified using the number of coconut producers. The total sample size was then estimated using a proportion [22]. The formula was given below.

$$n = Np(1 - p)/(N - 1)(d^2/z^2)+p(1 - p) \quad (1)$$

where:
n is the total sample size, *N* is the total population (*N=26,077*), *p=0.5* (assumed to be the worst-case value, if no estimate of *p* is available prior to the survey), *d* is the accepted error (assumed to be 5%), and *z* is based on confidence level (1.96 for 95%). Using the formula mentioned above, the total sample size found to be 378 [26,077*0.25/ (26,076(0.05/1.96) ^2+0.25)]. Hence, to reach the consistent results a total of 400 sample size was used in the survey. The Proportionate stratified sampling is used when the number of elements from each stratum about its proportion in the total population is selected [13]. Therefore, the samples were selected proportionally to the size of each stratum in the population. The formula used was:

$$n_h = N_h / N * n \quad (2)$$

where:
n_h is the total sample of stratum *h*, *n* is the total sample size (*n = 400)*, *N* is the total population, and N_h is the total population of stratum *h*. Hence, n_1 = 223 (14,541 / 26,077 * 400), n_2 = 137 (8,937 / 26,077 * 400), and n_3 = 40 (2,599 / 26,077 * 400). Simple random sampling (SRS) was applied to determine which municipality to be chosen as the study area. This was used so there were no biases on the sampling procedures. Based on the fishbowl draw Municipality of Bacolod was selected for the first district, Municipality of Munai for the second district, and the Municipal city of Iligan for the lone district.
To reach the objectives of this study, primary data was collected using a closed-ended survey questionnaire. The survey was conducted from October to November 2016 in the study area. The polls used in this study were in English; however, it was translated into a vernacular language which is Visayan dialect so that the respondents were able to understand the questions fully and ready to answer it conveniently. Secondary data were also used for further understanding of the study and the discussion of the impact of coconut production on the environment.

Data Analysis

Quantitative data were analyzed by the assistance of Statistical Package for the Social Sciences (SPSS) version 23. Descriptive characteristics of the coconut producers were presented through frequencies and percentage. For the objectives of this study 5-point Likert scale analysis was administered to describe the level of problems encountered by the coconut producers in coconut production. Respondents were ask to rate the given problems from 1 to 5 point where 1 = Not at all problem, 2 = Minor problem, 3 = Moderate problem, 4 = Serious problem, and 5 = Very serious problem. Percentage and frequency distributions were used frequency also as supporting data.
Also, multiple linear regressions were applied to determine the factors influencing the income of the coconut producers in coconut production. The case model was specified as follows:

$$\text{In } Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \ldots..+\varepsilon i \quad (3)$$

where:
Y is a dependent variable, which is the annual income of the coconut producers in coconut production. B_0, $\beta_1....\beta_{10}$ = Constants; X_1 (Sex of the respondents); X_2 (Age measured in years); X_3 (Marital status); X_4 (Education); X_5 (Number of coconut trees planted per hectares); X_6 (Size of the land in hectares); X_7 (Type of coconut planted); X_8 (Topography of the land); X_9 (Distance of the land from farm to the market road); X_{10} (Frequency of harvesting nut).

RESULTS AND DISCUSSIONS

Demographic profile of the coconut producers

This section provides the frequencies and ratios of the demographic profile of the respondents (coconut producers) such as age, sex, marital status, educational attainment, and annual income on coconut production (Table 1).

More than half (51.5%) of the coconut producers were female while 48.5% were male. This finding indicates that female coconut producers have more power owning coconut land. However, a study by Khalfan (2015) contradicts this finding in which she found 91% male and only 9% of female were engaged in coconut production [11].

The highest frequency of respondents in terms of age fells into the bracket of 30-40 years old with a total of 138 coconut producers (34.5%) followed by 132 coconut producers (33%) from the bracket of 41-50 years old. Whereas, the lowest frequency of fells into the bracket of lesser than 30 years old with only 41 coconut producers (10.3%). This implies that most of the respondents engaged in coconut production were adult ranging from age 30 to 50 years old.

The study used four categories such as single, married, divorced, and widowed to identify the marital status of the respondents — the survey results that the most significant proportions of the coconut producers were married (83.3%). A small percentage of 6.8% were single, 5.3% were widowed, and 4.8% were divorced. This may be interpreted that married coconut producers are highly dependent on coconut farming for their families. A similar study proved this finding [11].

Almost half (49%) of the respondents had basic education. While 24.8% had a secondary school, 23.8% had no formal training. It can be interpreted that illiteracy of the coconut producers is low. A small ratio of the respondents had finished the higher education level where 2% finished undergraduate school, and 0.5% finished post-graduate school.

The study further revealed that about 41% of the respondents have an annual income of greater than 40,000 Philippine pesos (PHP) followed by 31% of the respondents having a yearly salary between 32,001 to 40,000 PHP. While 15% found to have an annual income of lesser than 24,000 PHP, a small ratio of 12% of the respondents have a yearly income of 24,001 to 32,000 PHP in coconut production. The results imply that the annual income of the coconut producers in coconut production is meager. A similar study revealed that 88.05% categorized to have an average yearly salary of 75,000 PHP [20].

Table 1. Demographic profile of the respondents

Demographic profile		Frequency	Percent
Sex	Male	194	48.5
	Female	206	51.5
	Total	400	100.0
Age	< 30 years old	41	10.3
	30 - 40 years old	138	34.5
	41 - 50 years old	132	33.0
	> 50 years old	89	22.3
	Total	400	100.0
Marital Status	Single	27	6.8
	Married	333	83.3
	Divorced	19	4.8
	Widowed	21	5.3
	Total	400	100.0
Educational Attainment	Primary	196	49.0
	Secondary	99	24.8
	Undergraduate	8	2.0
	Post-graduate	2	0.5
	No formal education	95	23.8
	Total	400	100.0
Annual Income In coconut production	< 24,000 Php	61	15.3
	24,001 - 32,000 Php	51	12.8
	32,001 - 40,000 Php	124	31.0
	> 40,001 Php	164	41.0
	Total	400	100.0

Source: Own calculation.

Geographic profile of the coconut producers

The geographic pattern of the respondents includes the size of the coconut farm, the number of coconut trees planted, type of coconut tree planted, the topography of the land and the distance of the property from the farm to the market road were presented into frequencies and ratios (Table 2).

The Table 2 shows that 37.8% of coconut producers own a coconut farm between 2.5 to 3 hectares while 34.5% own between 1.5 to 2 hectares. It was further shown that the lowest proportion of 11.3% of the coconut producers owns lesser than 1.5 hectares.

Majority of the coconut owners (65.8%) planted more than 150 coconut trees per hectares while the small number of coconut owners (5.5%) planted less than 50 trees per hectares. Of the coconut land own by the coconut producers, it was shown that 48.5% own a plain topography of the property.

While 40.3% own a coconut farm located on the mountainside. A vast majority of the coconut owners (70.3%) own a coconut farm

with a distance of more than 500 meters away from the farm to market road.

Table 2. Geographic profile of the coconut producers

Geographic profile		Frequency	Percent
Size of the coconut farm	< 1.5 hectare	45	11.3
	1.5 - 2 hectare	138	34.5
	2.5 - 3 hectare	151	37.8
	> 3 hectare	66	16.5
	Total	400	100.0
Number of coconut tree planted per hectare	< 50 trees	22	5.5
	50 - 100 trees	43	10.8
	101 - 150 trees	72	18.0
	> 150 trees	263	65.8
	Total	400	100.0
The topography of the land	Plain	194	48.5
	Mountainside	161	40.3
	Rocky ground	25	6.3
	Hilly	20	5.0
	Total	400	100.0
The distance of the land from farm to market road	< 100 meters	12	3.0
	100 - 300 meters	35	8.8
	301 - 500 meters	72	18.0
	> 500 meters	281	70.3
	Total	400	100.0

Source: Own calculation.

Type of the coconut planted

This section identifies the variety of coconut planted by the coconut producers to their land. The recognized two varieties were tall and dwarf. Other natural coconut planted trees were the hybrid and the so-called queen coconut tree.

The Table 3 shows that the majority of the coconut producers (66.5%) planted a tall variety; which is the widely known variety of coconut tree. Only 4.5% of coconut producers planted a dwarf variety. While 18.5% planted coconut tree so-called queen coconut, 10.5% planted a hybrid coconut variety. On the other hand, a parallel study revealed that 51.2% of the coconut producers had planted queen variety of coconut however 32.4% of the coconut producers have planted the tall variety of coconut [25].

Table 3. Type of coconut planted to coconut land

Type	Frequency	Percent
Dwarf coconut	18	4.5
Tall coconut	266	66.5
Queen coconut	74	18.5
Hybrid coconut	42	10.5
Total	400	100.0

Source: Own calculation.

Impact of coconut production on the environment

Literature have revealed that coconut products or by-products have less effect on the environment. It has been established that the coconut palm tree wastes have minimal impact on the environment [16]. Coconut products do not destroy the situation where non-food coco products remain stable in the industrial markets [19]. The demands for soaps, detergents and other cleaning agents and personal care products which used oleo-chemicals are almost unlimited [9]. The husks are generally considered as a waste product, however utilizing this waste can turn into by-products such as rope, mattress filling, and coir [21]. The coir product extracted from coconut husk can helps to restore Mother Nature's beauty and vigor by rehabilitating agricultural lands and prevents erosion of topsoil [9].

Furthermore, production of fiberboards from unripe green coconut coir and fibers may reduce the environmental burden related to husks disposal [14]. It has been reported that the coconut industry globally generated as much as 408,216,000 tons of husks in 2013 [14]. A study has mentioned the variety of environment-related uses of activated carbon produced from coconut shell charcoal [23]. Moreover, this activated carbon can be used in some applications of water purification, gas masks, solvent recovery, and odor control, air purification in closed rooms, wastewater treatment plants and de-chlorination [23].

On the other hand, Coconut crop production results in many environmental aspects, including the use of large volumes of water for irrigation, land use transformation, and fertilizer use [14]. Monoculture farming becomes an issue in areas where coconuts are grown [15]. Growing coconut tree as a mono-crop promotes an environment of low crop diversity that can be damaging to the environment and risky for farmers [3]. As the coconut tree ages, it becomes less productive, and this leads to farmers to plant more coconut trees [15]. Consequently, it leads the farmers to use chemical fertilizers to boost their productivity; hence it can take a significant toll on the soil [15]. Moreover, when chemical fertilizers are introduced, it can be a threat to local biodiversity as well as land, water and air health [15]. It has been revealed in a study that the coconut oil extracted from copra, the dried kernel of the coconut is associated with little environmental pollution [23].

Factors affecting coconut production

This section presents the internal and external factors that affect coconut production in Lanao del Norte. The internal factors will mainly focus on the problems encountered in the production, marketing, management, and labor during the coconut production. On the other hand, government taxes, indiscriminate cutting of coconut trees, the low and fluctuating price of coconut product, coconut monopoly, and natural disasters will be considered external factors.

Production Problems

The findings (see table 4) show that pests and diseases considered by the coconut producers as a severe problem they encountered. It was found by 32.3% of coconut producers that pests and diseases were a serious problem. While 31.5% confirmed it as a severe problem, a small ratio of 4.3% of coconut producers did not confirm as a problem at all. In line with this findings discussed that infestation of pests and diseases were one of the risks that lead to a downgrading of the quality of coconut product like coconut oil and decrease the quantity of the coconut production [18].

A problem in nut collection was also found as a serious problem. This problem was attested by 28.0% of coconut producers as a severe problem while 7.8% did not confirm it as a problem at all. This implies that coconut workers had trouble in collecting the harvested nuts. Hence, it lessens the production of coconut since the accumulated may not be found in the collections of nuts.

The study further shows that infertility of the coconut tree was considered as a moderate problem with 29.0% of coconut producers considered it while at least 15.0% of coconut producers considered the issue as not a problem at all. This is probably because 88% of the coconut producers do not use any fertilizer to help boost coconut productivity [1].

28.3% of coconut producer considered the decline of the coconut tree as a minor problem only. However, 25.8% of coconut producers stated the issue like a severe problem while 6.5% reported it as not a problem at all. It has been revealed in a similar study that old age of coconut palms had a significant contribution towards the low production of coconut yields [11].

On the other hand, the majority of the coconut producers (64.3%) confirmed that infertility of the land did not show to be the problem at all. Only 2.5% and 4.5% indicated the issue like a severe and severe problem respectively. In contrast, other literature showed that low coconut productivity is generally associated with farmers' dependence on inherent soil productivity [5].

Table 4. Level of Problems Encountered by Coconut Producers on Production (n=400)

Problems	Not at all problem (1)		Minor problem (2)		Moderate problem (3)		Serious problem (4)		Severe problem (5)		Mode	Description of the problem
	F	%	F	%	F	%	F	%	F	%		
Pests and Diseases	17	4.3	38	9.5	90	22.5	129	32.3	126	31.5	4	Serious
Problems in nut collection	31	7.8	83	20.8	97	24.3	112	28.0	77	19.0	4	Serious
Infertility of the coconut tree	60	15.0	76	19.0	116	29.0	64	16.0	84	21.0	3	Moderate
The senility of the coconut tree	26	6.5	113	28.3	79	19.8	79	19.8	103	25.8	2	Minor
Infertility of the Land	257	64.3	90	22.5	25	6.5	18	4.5	10	2.5	1	Not at all

Source: Own calculation.

Marketing Problems

The table 5 shows that the coconut producers considered the far distance of the land from the farm to the market road as a severe problem they encountered. This problem was attested by 33.5% of coconut producers while about 10.3% did not consider it as a problem at all. This suggests that the government

should increase its agricultural infrastructures in the province. Farm to market road projects should be the priority to lessen the burdens of the coconut producers in delivering their coconut products to the market area.

32.3% of coconut producers considered high transportation was a severe problem they encountered. While 30.8% of coconut producers found the issue like an acute problem, a small ratio of 5.5% did not consider it as a problem at all. This is probably because the roads in the area are deplorable. A parallel study found high transportation cost not a problem in marketing the coconut [20].

A majority of 43.0% of coconut producers considered multiple channels of distribution of coconut products as a moderate problem. While 27.5% found it as a serious problem, only 3.0% did not think it as a problem at all. It has been observed that the medium of the transportations used by the coconut producers during the coconut production was delivery truck (46.5%), animal cart (26%) (Using *carabao*; a water buffalo, a cow, or a horse), and motorcycle (21.3%). This is in line with a similar study that multiple channels of distribution of coconut products found to be the second-ranked problem encountered in marketing coconut [25].

The findings in table 5 further revealed that the seasonal price variation to be a minor problem. It was considered by about a half of (49.5%) coconut producers. While 11.3% did not consider the problem as a problem at all. Seasonal variation of prices indicated to be one of the problems that existed in marketing coconut found [25]. On the other hand, other similar literature revealed that the unstable price of copra was a severe problem encountered by the coconut producers [20].

Whereas, a vast majority of coconut producers (70.5%) considered that limited market information was not a problem at all. Only 5.3% and 3.5% thought the issue as a serious and severe problem respectively. This finding suggests that coconut producers have important knowledge about the market scenario in the province of Lanao del Norte.

Table 5. Level of Problems Encountered by Coconut Producers on Marketing (n=400)

Problems	Not at all problem (1)		Minor problem (2)		Moderate problem (3)		Serious problem (4)		Very serious problem (5)		Mode	Description of the problem
	F	%	F	%	F	%	F	%	F	%		
Distant distance of the land from farm to market road.	41	10.3	54	13.5	89	22.3	82	20.5	134	33.5	5	Very Serious
High transportation expenses.	22	5.5	65	16.3	61	15.3	129	32.3	123	30.8	4	Serious
Multiple channels of distribution.	12	3.0	30	7.5	172	43.0	110	27.5	76	19.0	3	Moderate
Seasonal price variation.	45	11.3	198	49.5	53	13.3	57	14.3	47	11.8	2	Minor
Limited market information	282	70.5	56	14.0	27	6.8	21	5.3	14	3.5	1	Not at all

Source: Own calculation.

Management Problems

When the levels of the problems encountered in the management aspect were analyzed (Table 6) the study indicates that the problem in intercropping management was a severe problem considered by 29.8% of coconut producers. On the other hand, 25.8% found the problem as not a problem at all. This probably due to the facts that the majority of the respondents do not have a tenant in their land. It has been observed that 41% of the coconut producers hired a tenant to take care of the coconut land. This implies that coconut producers do not want to engage more on intercropping. The main bottleneck in the adoption of optimum management practices in the coconut-based farming system (CBFS) particularly in intercropping is that the small farmers are burdened with substantial costs of production as well as in the marketing of their produces [12]. Further study revealed that coconut producers face insufficient land for intercropping [11].

Moreover, according to the findings of the study, the percentage sharing of income found to be a moderate problem; this was considered by 25.0% coconut producers. While 22.8% and 23.3% of coconut producers felt the issue as a serious and very serious problem respectively, 12.3% did not consider it as a problem at all. This suggests that coconut producer who had hired a tenant on their coconut land had experienced a problem with their tenant with regards to tenancy agreements on sharing of coconut yield.

The problem in coconut sharing of costs and expenses of the coconut production indicated to be a minor problem. While 23.5% of coconut producers considered the issue as a small problem, 13.3% did not think it as a problem at all. It was observed that the traditional practices of coconut producers in Lanao del Norte were the expenses during the coconut productions are shouldered by the owner and the tenant equally. The study revealed that sharecropping was considered by 24.5% of coconut producers as a minor problem. However, 23.3% and 18.5% of coconut producers considered the issue as a serious and very serious problem while 19.5% did not consider it as a problem at all. This may be interpreted that sharecropping is not standard management practices in the province.

The study further revealed that tenure-arrangement on duties and responsibilities was not a problem at all according to 29.5% of coconut producers who considered it. However, while 28.8% considered it as a minor problem a small ratio of 7.0% considered the problems as a very serious problem. This implies that coconut producer has no problem with tenants' performances of duties and responsibilities during the coconut production.

Table 6. Level of Problems Encountered by Coconut Producers on Management (n=400)

Problems	Not at all problem (1)		Minor problem (2)		Moderate problem (3)		Serious problem (4)		Very serious problem (5)		Mode	Description of the problem
	F	%	F	%	F	%	F	%	F	%		
Problems in Intercropping	103	25.8	25	6.3	74	18.5	79	19.8	119	29.8	5	Very Serious
Percentage sharing of income	49	12.3	67	16.8	100	25.0	91	22.8	93	23.3	3	Moderate
Problems in coconut sharing of coconut productions' costs and expenses	53	13.3	94	23.5	80	20.0	89	22.3	84	21.0	2	Minor
Problems in Sharecropping	78	19.5	98	24.5	57	14.3	93	23.3	74	18.5	2	Minor
Tenure-Arrangement on duties and responsibilities	118	29.5	115	28.8	85	21.3	54	13.5	28	7.0	1	Not at all

Source: Own calculation.

Labor Problems

Based on the results in Table 7, it indicates that the high cost of labors was considered by 45.0% coconut producers as a very serious problem encountered. While 27.3% considered the problem as a serious problem a small proportion of 2.3% considered it as not a problem at all. A similar study found that high cost of labors is one of the prime problem faced by coconut producers in Tamilnadu, India [25].

The small duration of work, however, was found to be a moderate problem which 28.8% of coconut producers considered it. While 27.8% considered the problem as a minor problem only 5.8% considered it as a very serious problem. A similar study revealed the same results [25].

Also, the results indicated the problem on unskilled workers was found to be a minor problem and considered by 29.0% coconut producers. On the other hand, while 27.0% considered the problem as an average 15.5% did not consider it as a problem at all. The study further revealed that inadequacy of the coconut workers during the working period found to be a minor problem considered by 27.8%. Only 6.5% did not consider it a problem at all. However, 25.3% and 26.8% of coconut producers considered the problem as a serious and very serious problem. This implies that most of the respondents found the

problem as an alarming problem. A similar study supports this finding that inadequacy of the coconut workers was a prime problem encountered by the coconut producers [25].
Furthermore, a great majority of coconut producers (58.8%) considered the migratory of the workers as not a problem at all while 10.0% and 10.8% considered the problem as a serious and very serious problem.

Table 7. Level of Problems Encountered by Coconut Producers on Labor (n=400)

Problems	Not at all problem (1)		Minor problem (2)		Moderate problem (3)		Serious problem (4)		Very serious problem (5)		Mode	Description of the problem
	F	%	F	%	F	%	F	%	F	%		
High cost of Labors	9	2.3	26	6.5	76	19.0	109	27.3	180	45.0	5	Very Serious
Small duration of work	67	16.8	111	27.8	115	28.8	84	21.0	23	5.8	3	Moderate
Unskilled workers	62	15.5	116	29.0	108	27.0	67	16.8	47	11.8	2	Minor
Inadequacy of workers	26	6.5	111	27.8	55	13.8	101	25.3	107	26.8	2	Minor
Migratory workers	235	58.8	40	10.0	42	10.5	40	10.0	43	10.8	1	Not at all

Source: Own calculation.

External problems
The findings (Table 8) indicated that low and fluctuating price of coconut product was found to be a very serious problem encountered by the coconut producers. Of the total coconut producers, more than a half (52.5%) indicated the problem as a very serious problem while a small proportion of 0.8% reported it as not a problem at all. The government tax imposed by the local government is a serious problem. This finding was considered by 29.0% coconut producers while only 8.0% considered the problem as not a problem at all. The finding suggests that local government should lessen the tax imposed on coconut producers particularly on the smallholder coconut producers.
The findings further indicated that coconut monopoly was a moderate problem encountered by the coconut producers. 29.5% considered this problem as a moderate problem. While 11.0% considered this problem as a very serious problem 14.0% thought it is not a problem at all. Indiscriminate cutting of coconut trees indicated to be a minor problem were 37.5% of coconut producers considered this problem. Of the total coconut producers, only 7.0% thought the problem as a very serious problem while 9.3% viewed it as not a problem at all. Further findings found that natural disasters were not a problem at all where a significant majority (68.0%) of coconut producers considered it. While 12.3% considered the problem as a minor problem, 5.5% and 9.3% considered it as a serious and very serious problem.

Table 8. Level of external Problems Encountered by Coconut Producers (n=400)

Problems	Not at all problem (1)		Minor problem (2)		Moderate problem (3)		Serious problem (4)		Very serious problem (5)		Mode	Description of the problem
	F	%	F	%	F	%	F	%	F	%		
Low and fluctuating price of coconut product	3	0.8	27	6.8	62	15.5	98	24.5	210	52.5	5	Very Serious
Government taxes	32	8.0	76	19.0	97	24.3	116	29.0	79	19.8	4	Serious
Coconut monopoly	56	14.0	98	24.5	118	29.5	84	21.0	44	11.0	3	Moderate
Indiscriminate cutting of coconut trees	37	9.3	150	37.5	101	25.3	84	21.0	28	7.0	2	Minor
Natural disasters	272	68.0	49	12.3	20	5.0	22	5.5	37	9.3	1	Not at all

Source: Own calculation.

Factors influencing the income of the coconut producers

The results revealed in the regression analysis indicate that sex of respondents had no significant influence (p=0.938) on the income of the coconut producers and it had a negative relationship (β =-0.006) to the dependent variable. This result is probably because most of the coconut owners were female.

Age of the respondents indicated no significant influence (p=0.285) on the income of the coconut producers and had a negative relationship to the dependent variable (β=-0.056). This implies that the increase of the age of the coconut producers the income of the coconut producers decreased by 0.056.

The marital status of the respondents showed no significant influence (p=0.392) on the coconut producers' income, but it has a positive relationship (β=0.057). This is maybe because the majority of the coconut producers were married. It implies that family responsibilities matter most.

Table 9 indicated further that the educational attainment of the respondents have a significant influence (p=0.050) on the income of the coconut producers and shows a positive relationship between the dependent variable (β=0.057). This means that additional year of the education by the coconut producers their income on coconut production would increase by 0.057. This result is in line with the study by Khalfan (2015) in which he found that education had a high influence on income [11].

The findings further revealed that size of the land owned by the coconut producers had a high influence (p<0001) on their income in coconut production and showed a more significant relationship to the dependent variable (β=0.452). This finding implies that an increase of the hectare of the land owned by the coconut producers the higher the possibility that their income would increase by 0.452. Literature argued that an increase in the land under improved technologies would increase coconut yield [11].

The number of coconut tree planted to coconut farm indicates a greater influence (p<0001) on the income on coconut production and carries a positive relationship to the dependent variable (β=0.593). Therefore, an increase in the number of coconut trees planted on the coconut farm income on coconut production would increase by 0.593.

When the type of coconut planted to coconut farm was analyzed, it showed no significant influence (p=0.481) on the income on coconut production. However, it has a positive relationship with coconut yield (β=0.035). This is probably because the tall variety is widely planted coconut.

The topography of the land was found to have no significant influence (p=0.080) on the income on coconut production but had a positive relationship to the dependent variable (β=0.089). Based on the demographic results of this study about the topography of the land, the majority of the respondents owned plain coconut land.

Table 9. Results of regression for analysis of factors influencing the income of the coconut producers

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.633	0.274		2.311	0.021
Sex	-0.006	0.081	-0.003	-0.078	0.938
Age	-0.056	0.052	-0.048	-1.071	0.285
Marital Status	0.057	0.067	0.030	0.856	0.392
Educational Attainment	0.051	0.026	0.077	1.969	0.050*
Size of the land (in hectare)	0.452	0.054	0.377	8.425	0.000**
Number of coconut tree planted per hectare	0.593	0.048	0.493	12.413	0.000**
Type of coconut planted	0.035	0.050	0.024	0.706	0.481
The topography of the land	0.089	0.051	0.067	1.758	0.080
The distance of the land from the market road	-0.122	0.049	-0.089	-2.512	0.012**
Frequency of harvesting nut	-0.268	0.063	-0.137	-4.255	0.000**

a. Dependent Variable: Income in copra production

*p ≤ 0.050; **p < 0.0001; R = 0.793; SS = 288.272; MS = 28.827; F = 65.760
Source: Own calculation.

Also, Table 9 also indicated that the distance of the coconut land from farm to market road had a significant influence (p=0.012) on coconut yield, but it had a negative relationship to the dependent variable (β=-0.122). This finding suggests that when the distance of the coconut farm is far from the farm to the market road, the coconut yield decreases by 0.122. This is may be due to the high transportation costs associated with transporting the finished coconut product.

The frequency of the harvest had shown a tremendous significant influence (p<0001) on the income on coconut production, however, shows a negative relationship to it (β=-0.268). This finding suggests that when the nuts are harvested on the early stage, the coconut yield will decrease by 0.286.

CONCLUSIONS

Based on the findings of the study it was concluded that married females dominated coconut producers in the Lanao del Norte. Most of the coconut producers were categorically adult between the ages of 30 to 50 years old. It was further concluded that coconut producers had primary education; however, the illiteracy rate was high. Moreover, the income of the coconut producers on coconut productions found to be low.

Based on the discussion, there are several positive impacts of coconut production on the environment than its negative effects.

The findings concluded that the severe problems encountered by the coconut producers in coconut production for internal problems were the far distance of the land from farm to market road in marketing problem, intercropping in management problem, high cost of laborers in labor problem, and low and fluctuating price of coconut product for external issues encountered. On the other hand, a severe problem was not recorded in the production problems. However, serious issues such as pests and diseases and problems in nut collections were concluded in the production problem. Other pressing issues found were high transportation expenses in marketing problem and government taxes for the apparent problem. Furthermore, moderate issues such as infertility of the coconut tree, multiple channels of distribution, percentage sharing of income, small duration of work, and Coconut monopoly were concluded and considered to be alarming problems.

Also, the regression results revealed that the educational Attainment, size of the land (in hectare), number of coconut tree planted per hectare, the distance of the land from the market road, and the frequency of harvesting nut have a strong influence on coconut production. To address these problems there is a need for the government, non-government organizations, different stakeholders and all actors, in general, to ensure that coconut producers are subjects to adequate land to have greater production and productivity.

Based on the discussions and conclusions of this study the following recommendations were generated and humbly offered.

(i)The governments should provide training and seminars on management of the land and the applications of new technologies on coconut farming like intercropping, fertilizers, seedlings and pesticides that will improve the farming of the coconut producers to increase the coconut yields.

(ii)The government should regulate policies that will control the monopolistic setting of coconut price by the dealers and coconut companies.

(iii)The government must implement a farm to market road and other infrastructure projects to ease the marketing of coconut products.

(iv)The farmers should be encouraged to participate in the programs of the government and be part of the implementation process.

(v)Further research on this study are supported and highly recommended.

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