Assessing the Rice Production and Its Determinants: Empirical Evidence from Albuera, Leyte, Philippines

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ABSTRACT. Rice is the most important crop grown in the Philippines since it is an essential food and a source of income for many Filipinos. The study's purpose is to determine the various influencing factors affecting the rice production of small-scale farmers in Albuera, Leyte, Philippines. Using Slovin's formula, a total of 73 rice farmers were randomly selected as respondents to the survey. Some descriptive techniques were employed to summarize the different variables. A categorical relationship analysis using a Chi-square test was used to analyze the significant factors of rice production. Results showed that about 57.53% and 42.47% of the farmers are experiencing low and high production levels, respectively. On average, rice farmers are "moderately affected" (M=23.00, SD=4.55) by the different constraints in the rice production process from planting to harvesting. In addition, farmers are "uncertain" (M=19.67, SD=3.01) about the effectiveness and usefulness of extension agents' role in their production process. Moreover, it is revealed that the demographic profile, constraints in rice farming, and extension agents' role does not affect the farmers' rice production level. On the other hand, other sources of income (p=0.034), monthly income in farming (p=0.13), and farm size (p<0.001) are the only significant determinants in the rice production level. Hence, the study suggested that rural farmers must be supported by the government concerning their agricultural inputs, capital, and equipment, among others. Furthermore, the local government must train their extension agents rigorously to appropriately disseminate the new technologies to farmers so that they can adopt them systematically to improve their level of rice production.

1.0. Introduction

Rice (scientifically known as *Oryza sativa* L.) is one of the significant crops in numerous developing nations worldwide. In particular, the Philippines is one of the countries in Asia where rice is the main staple food, and rice production has a big impact on the agriculture sector in the country (Mutert & Fairhurst, 2002; Casinillo, 2022a). In that case, the government has implemented laws and programs to enhance rice production in the country, including the rice tariffication law (Casinillo, 2020) and farmer field school (Red et al., 2021). It is worth noting that rice is the main source of income for many Filipinos in rural areas, especially for the poorest people in the country. However, the domestic rice production behavior is fluctuating, and it has impacted food security and even adversely affects the alleviation of poverty in the country (Koide et al., 2013; Balié & Valera, 2020). According to Samoy-Pascual et al. (2022), about 4.72 million hectares of land in the Philippines are devoted to rice production, and the annual yield production is approximately 19 million tons. In that case, the Philippines is one of the countries in Asia that exports rice. Nevertheless, during the COVID-19 pandemic, the country is considered moderately vulnerable to the rice crisis (Ling et al., 2021). On the face of it, many agricultural economists and scientists are researching how to improve rice production and progress the sustainability of rice farming and the supply chain in the country.

Leyte, Philippines, has a broad paddy farm; the main crop grown is rice (Casinillo, 2020). In that case, several farmers depend on their income and staple food for rice farming. However, most farmers are aging, traditional farmers possess low educational attainment, and their living status is below the country's poverty threshold (Casinillo & Seriño, 2022). So, their level of rice production activity is influenced by these constraints. On the face of it, these farmers need assistance from the government. Fortunately, the local government unit has provided an

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aid program, and one of these is called an agricultural extension agent that will resolve the farmers' problems and other concerns. The duties of extension agents to the farmers serve as educators, mediators, organizers, facilitators, solution givers, and enablers (Casinillo, 2022b). In fact, according to Aguda et al. (2022), the target of the province of Leyte, Philippines, is to have a sustainable, resilient, and high earning in agriculture and to ensure the availability of food to individual family's table. Moreover, there are agricultural and rural development studies that were conducted to give information and to address the needs of farmers and progress their production activities in Leyte (Ruales et al., 2020; Castillo et al., 2021; Seriño et al., 2021; Casinillo & Seriño, 2022; Parilla et al., 2022). Furthermore, it is necessary to support the small-scale farmers in Leyte since they face challenges due to input supply constraints, climatic conditions, financial aspects, pests and diseases, and agricultural equipment, among others (Ruales et al., 2020; Red et al., 2021).

According to the study by Munyua (2000), farmers with a lack of farming information about innovative technologies in agriculture hinder the production level. Hence, it is necessary to investigate to progress the farmers' knowledge that affects their practices. Although there are existing studies from the literature concerning rice production in the Philippines, the inquiry from rural areas in the province of Leyte is scarce. Additionally, determining the causal factors in rice production using empirical evidence has never been conducted in Albuera, Leyte. Hence, this study is realized. In general, the article's main purpose is to elucidate the production level status of rice farmers and identify the significant determinants that influence production activity. Specifically, the study dealt with the following objectives: (1) to describe the demographic and socioeconomic profile of rice farmers; (2) to measure the rice production level; (3) to document the influencing determinants of the rice production activity. The results of this study may provide salient information for farmers and policymakers to amend the existing government programs concerning rice production in the country. This information may help improve rice farmers' current situation or status concerning agricultural inputs and other needs. Moreover, findings may increase the farmers' well-being and may better the efficiency in the production activity. Furthermore, results may use as baseline information for further studies in agricultural development.

2.0. Framework of the Study

Rice production in the Philippines has a lot of problems and issues that need to be addressed and amended. According to Estudillo et al. (1999), rice production in the country has diminished its comparative advantage over other rice-exporting countries due to the stagnation or decline of rice yields and the rising cost of agricultural inputs, among others. Likewise, Casinillo (2020, 2022a) depicted that low rice output price adversely affects rice production in the country. Stuecker et al. (2018) revealed that due to the climate variability in the country, or as a tropical climate country, rice production is affected by soil moisture, seasonal pest and diseases, and even temperature stress.

Moreover, the study by Alam et al. (2011) stated that rice productivity depends on the demographic and socioeconomic profile and constraints of farmers. Plus, Atera et al. (2018) stated that rice production and marketing have challenges, especially in the aspect of supply chain management. However, the Philippine government has been focusing on these problems and issues in rice production, which is an important contributor to Gross Domestic Product (GDP). Valenzona et al. (2020) stated that the local government had formed a farmers' association to discuss farming concerns and needs, especially farming techniques. Red et al. (2021) depicted a Farmer Field School program that will influence the farmers' knowledge and farming practices and improve the farmers' profitability. An extension agent is also part of the picture. The study by Maryani et al. (2017) stated that extension agents in agriculture had developed some strategies to improve rice production. And nowadays, there are a lot of agricultural technologies and farming techniques that farmers must adopt to increase farmer's well-being and production activity (Awotide et al., 2016).

Hence, the conceptual framework of this research article is to find out the influencing determinants of rice production, suggest some policies to improve the farmers' yield, and give solutions to the farmers' low productivity.

3.0. Methodology

A descriptive-correlational design was employed in this research study through cross-sectional survey data. The survey targeted the rice farmers of Barangay Poblacion, Albuera, Leyte, Philippines, whom extension agents and part of the Barangay Association of rice farmers influence are present. The researchers

believed the population of interest was enough to suffice and answer the survey. To acquire the desirable number of participants representing the whole picture, the sufficient sample size was approximated in relation to the total number of rice farmers who are also members of the Barangay association using Slovin's formula, for which the margin of error was set to 5%. The said formula is given as follows:

$$n = \frac{N}{1 + Ne^2}$$

where *n* is the sample size, *N* is the total population number of rice farmers, and *e* refers to the margin (sampling) error. The sampling frame for the rice farmers in the area of interest was asked from the Municipal Agriculture Office (MAO) of Albuera, Leyte. Hence, 73 participants (rice farmers) out of 90 members of the association were selected through simple random sampling (SRS) with random numbers. It is worth noting that Barangay Poblacion is one of the highest contributors to rice outputs in the Municipality of Albuera, Leyte.

An ethical procedure was also observed in the conduct of the survey. A letter of consent was first sent to the MAO of Albuera, Leyte. After the permission to conduct, the farmers involved in the survey were oriented that their participation is voluntary and the data gathered from them are solely used for research purposes only. The gathered information was kept confidential to protect the farmers' privacy. And the survey was carried out in June, the year 2022.

The research instrument used in the survey was a developed semi-structured questionnaire that contains four major parts as follows: (1) socio-demographic profile of farmers; (2) level of rice production; (3) perception of farming constraints; and (4) perception to the extension agents' role. The socio-demographic profile consists of the following items: age, sex, educational attainment, civil status, household size, religion, other sources of income, monthly income, tenure status, years of experience in farming, and farm size. In determining the level of rice production, the following formula was used:

$$Level\ of\ Rice\ Production\ (LRP) = \frac{No.\ of\ Sacks}{Farm\ Size}$$

If $LRP \geq 72$, then the yield is considered "high," and if $LRP < 72$, then the yield is considered "low." The calculation is based on the average yield of 1 hectare, equal to 3.6 metric tons or 72 sacks (Laborte et al., 2012). For the farmers' perception of constraints in farming, the respondents were asked to rate (Scale of 1 to 4; 1 refers to not affected and 4 being severely affected) the following: high inputs, lack of post-harvest facility, land rent, lack of credits facilities, lack of technical services, high cost of transportation, inadequate capital, inaccessibility to land, pest and diseases, weeds, and low soil fertility. Lastly, for the perception of farmers to extension agents, they were asked to rate (Scale of 1 to 5; 1 refers to highly ineffective and 5 being highly effective) the following roles: educator, mediator, organizer, facilitator, solution giver, and enabler. The perception scores in each category were summed. Hence, Table 1 and 2 shows the possible perception score of farmers to constraints and extension agents' role.

The data collection was obtained by conducting a face-to-face interview with the farmers at their respective homes, where the question was translated into Cebuano. After gathering the data, the qualitative response was coded and transformed into a quantitative one. Next, the data were encoded to Excel and formatted that suits STATA version 14.0. In describing the data, the study used statistical measures such as frequency counts, percentages, mean, chi-square for the goodness of fit, and standard deviation (SD). And in determining the causal factors affecting rice production, a categorical relationship analysis was done in the form of a Chi-square test of independence and tested at the following level of significance: 1%, 5%, and 10%.

Table 1
Farmers' perception score to constraints

Range of perception scores	Verbal description
11 - 19	Not affected
20 - 28	Moderately affected
29 - 36	Affected
37 - 44	Severely affected

Table 2
Farmers' perception score of extension agents

Range of perception scores	Verbal description
6 - 10	High ineffective
11 - 15	Ineffective
16 - 20	Uncertain
21 - 25	Effective
26 - 30	Highly effective

4.0. Results

Demographic and socioeconomic profile

Table 3 depicts the demographic and

socioeconomic profile of the rice farmers. Most rice farmers are relatively old, aged 56-65 years old (28.77%) and 66-75 years old (39.73%). On average, the mean age of these rice farmers is close to 57.80 years old. This result is consistent with the study by Casinillo (2020) that most farmers nowadays are aging individuals. This is because the youth are sent to school to obtain a degree and find a respectable, high-income job instead of farming.

About 63.01% of these rice farmers are male, and 36.99% are female. Most of these farmers have only elementary level (52.05%) in their educational attainment, about 36.99% are

Table 3
Demographic and socioeconomic profile of rice farmers

Variables		Frequency	Percentage (%)
Age	36 - 45	4	5.48
	46 - 55	14	19.18
	56 - 65	21	28.77
	66 - 75	29	39.73
	76 and above	5	6.85
	Mean:	57.80	
Sex	Male	46	63.01
	Female	27	36.99
Educational Attainment	Primary	38	52.05
	Secondary	27	36.99
	Tertiary	8	10.96
Civil Status	Single	2	2.74
	Married	65	89.04
	Widowed	6	8.22
Household Size	2-6 members	55	75.34
	7-11 members	18	24.66
Religion	Roman Catholic	62	84.93
	Iglesia Ni Cristo	3	4.11
	Born Again	1	1.37
	Jehova's Witness	2	2.74
	Baptist	1	1.37
	Seventh Day Adventists	3	4.11
	Others	1	1.37
Other Sources of Income	Fishing	17	23.29
	Small Scale Business (*Sari-sari store, coconut wine seller*)	16	21.92
	Hired Labor	15	20.55
	Government Employed	10	13.70
	Remittance	6	8.22
	None	5	6.85
	Others *(band services, carpentry, driver*)	4	5.48
Monthly Income (PHP)	5,000 and below	53	72.60
	5,001 – 10,000	18	24.66
	10,001 – 15,000	2	2.74
	Mean	502.74	
Tenurial Status	Landowner	16	21.92
	Tenant	43	58.90
	Both	14	19.18
Years of Experience in Rice Farming	6 - 20	40	54.79
	21 - 35	26	35.61
	36 - 50	7	9.59
Farm size	Less than 1 hectare	47	64.38
	1 hectare and above	26	35.62

high school level, and only 10.96% are college level. This implies that most of the farmers had a low level of education. Additionally, the majority of these farmers are married (89.04%) and have a family to provide for their needs. Very few are single (2.74%), and about 8.22% are widowed. Most of these farmers have a household size range of 2-6 members (75.34%), and 24.66% have 7-11 members. Almost all of these rice farmers have a religion of Roman Catholicism (84.93%).

The majority of the farmers have another source of income (93.15%) to sustain their needs for their families, and only 6.85% of them are purely rice farmers. However, many of these farmers have only 5,000 (PHP) and below (72.60%) as their monthly income. Approximately, their mean monthly income in rice farming is close to 502.74 (PHP). On average, almost all of them are earning below the poverty threshold in the country. About 58.90% of these farmers are only tenants on their farmland and pay rent as an additional expense in the rice production. Furthermore, 54.79% of these farmers have experience 6-20 years in rice farming, 35.61% are 21-35 years, and only 9.59% are 36-50 years. Lastly, the majority (64.38%) of these rice farmers have cultivated less than 1 hectare of paddy field and about 35.62% have cultivated 1 hectare or greater.

Rice Production

Table 4 shows that more than half (57.53%) of the farmers are experiencing a low level of rice production. This implies that some constraints and problems affect their productivity and efficiency in farming. According to Fahad et al. (2019), some factors adversely affect the production activity in farming, including the constraints of farmers concerning technology and knowledge, socioeconomic issues, water and soil problems, pest, diseases, and weather problems, among others. On the other hand, about 42.47% of the rice farmers said they had experienced a high production level. This implies that some constraints and problems do not affect their agricultural production.

In addition, Chowdhury et al. (2020) depicted that farmers with good harvests have adopted technologies suitable for increasing their productivity. Results showed that the level of rice production is uniformly distributed (χ^2=1.66, p=0.198) to low and high levels. However, statistically speaking, about an 80% (p-value=0.198) chance that a low level of production is more likely to occur than a higher level (Table 4). Hence, rice farmers must adopt new technologies that might help them increase efficiency and productivity in farming (Rozaki et al., 2020). In fact, Casinillo (2022a) suggested that rural farmers must be supported concerning their agricultural inputs and equipment so that they can easily progress their level of production.

Constraints and Extension Agents

Table 5 shows that no farmers are severely affected by constraints in farming. However, about 15.07% of these farmers said that they are affected by constraints in farming. This implies that the constraints hinder the productivity and efficiency of rice farming. In addition, the majority (67.12%) of them are moderately affected and said that constraints in farming are adversely affecting the yield. According to Suvi et al. (2021), major constraints such as pests and diseases, high inputs, poor soil fertility, inadequate capital, drought, and weeds, among others, limit the rice production level.

Likewise, a lack of knowledge of innovative agricultural technologies is also affecting the farmers' adaptive production practices, leading to poor productivity (Ismael et al., 2021). In that case, rural farmers need assistance to educate them on the dynamics of farming systems and suitable agricultural processes. On the other hand, about 17.81% of the farmers are not affected by farming constraints. This means their production level is high, and farmers have attained their expected yield within one cropping season. Moreover, farmers who said they are not affected by constraints are achieving good economic profit in rice farming. The chi-square test revealed that the frequency

Table 4
Level of rice production of the rice farmers

Rice production level	Counts	Percentage (%)	Chi-square test	p-value
Low	42	57.53	1.66^{ns}	0.198
High	31	42.47		
Total	73	100.00		

Note: ns - not significant

Table 5
Farmers' Perception of Constraints in Rice Production

Effect of constraints[a]	Frequency	Percentage (%)	Chi-square test	p-value
Severely affected	0	0.00	37.59*	<0.001
Affected	11	15.07		
Moderately affected	49	67.12		
Not affected	13	17.81		
Mean±SD = 23.00±4.55 (Moderately affected)				

Note: a - See Table 1; * - highly significant at 1% level.

of farmers is not uniformly distributed (χ^2 =37.59, p<0.001) concerning the different effects category of constraints. This implies that most (67.12%; Mean±SD = 23.004.55) of the rice farmers are significantly moderately affected by constraints in rice farming that lowered their productivity level.

It is revealed in Table 6 that only 2.74% of the farmers said that extension agents are "highly effective" in helping them. And about 41.10% say that their service is "effective" as an aid in progressing their rice farming production. According to Anang et al. (2020), agricultural extensions are the ones who is helping farmers improve their productivity in rice production by educating them on the right solution. Hence, they influence the farmers' adoption of new methods and techniques in the farming system that will enhance their profitability. Likewise, Olorunfemi et al. (2020) said that extension agents are responsible for disseminating new agricultural technologies to the farmers to improve their practices and knowledge. However, the majority (47.95%) of these farmers are uncertain about the effectiveness of extension agents' role. This implies that farmers are doubting if the extension agents are helping in their production.

In fact, Olorunfemi et al. (2020) stated that many initiatives in technologies are not totally disseminated or imparted to rural rice farmers. Moreover, 8.22% of the farmers said that extension agents are ineffective in improving their production activities. The chi-square test result shows that the farmers' perception is not uniformly distributed (χ^2=45.63, p<0.001) to the categories of the effectiveness of extension agents' role. This means that it is significant that the majority of them are "uncertain" (Mean±SD=19.67±3.01) about the service of extension agents concerning their productivity in rice farming.

Determinants of rice production

The demographic profile of farmers, such as age (p=0.737), sex (p=0.793), educational attainment (p=0.145), civil status (p=0.406), household size (p=0.366), religion (p=0.122) is not significant determinants in their production in rice farming (Table 6). In other words, regardless of low and high productivity in farming, the said demographic profile of these farmers does not influence the production level. This result is not parallel to the findings of Bhandari and Mishra (2018), that found that demographic transformation nowadays impacts rice farming productivity. Table 7 reveals that other sources of income (p=0.034) and monthly income (p=0.013) are significant determinants of rice production level. This implies that their other source of income helps sustain their capital in farming and buy agricultural inputs needed for production. According to Fantón et al. (2021), another source of income helps sustain productivity since it gives additional benefits to the farmers, especially in providing needs in farming.

Additionally, farmers' monthly income provides them with benefits and comforts, which motivates them to work harder in the field, which improves their efficiency and productivity in farming (Casinillo & Seriño, 2022). Table 7 also

Table 6
Farmers' Perception of extension agents' Role

Extension agents' role[b]	Frequency	Percentage (%)	Chi-square test	p-value
Highly effective	2	2.74	45.63*	<0.001
Effective	30	41.10		
Uncertain	35	47.95		
Ineffective	6	8.22		
High ineffective	0	0.00		
Mean±SD =19.67±3.01 (Uncertain)				

Note: b - See Table 2; * - highly significant at 1% level.

Table 7
Chi-square test for determinants of rice production

Determinants	Chi-Square Test for Independence	
	χ^2-computed	p-value
Age	1.992^{ns}	0.737
Sex	0.068^{ns}	0.793
Educational Attainment	3.856^{ns}	0.145
Civil Status	1.804^{ns}	0.406
Household size	0.816^{ns}	0.366
Religion	10.066^{ns}	0.122
Other sources of income	10.442*	0.034
Monthly income	8.710*	0.013
Tenurial Status	0.214^{ns}	0.898
Years of Experience in Rice Farming	0.001^{ns}	1.000
Farm size	15.809**	<0.001
Perception to farming constraints	0.129^{ns}	0.938
Perception to extension agents' role	3.011^{ns}	0.390

Note: ns - not significant; ** -highly significant at 1% level; * -significant at 5% level.

shows that tenurial status (p=0.898) and years of experience in farming (p=1.00) are not significant causal factors in their production level. However, farm size (p<0.001) is a highly significant determinant in the production level. This implies that if the farmer has a big size of rice field, they can be more productive and more likely to increase their profitability. This is because they have more opportunities to plant and cultivate more rice plants. In fact, according to Casinillo (2020), a farmer that cultivates a large rice farm is more likely to be motivated and progressive to work. In the study by Bidzakin et al. (2020), it is stated that with bigger farms for production, farmers tend to have more yield and economic profit. Lastly, Table 7 reveals that the effects of constraints (p=0.938) and extension agents (p=0.390) in rice farming are not significant to the farmers' rice cultivation and production.

5.0 Conclusion

The article's main objective is to assess the level of production and elucidate the different determinants that affect and influences the farmers' productivity in their rice production. Results revealed that more farmers are experiencing a low level of production compared to a high level. This is because most farmers are moderately affected by the adverse influence of farming constraints from planting to harvesting procedures. This implies that farmers are having some problems concerning their agricultural inputs, cultivation, pest and disease management, and harvesting procedure, among others. In addition to that, on average, farmers are uncertain about the impact of extension agents in their production process.

It is concluded that the role of extension agents has not appropriately addressed the farmers' needs and concerns. In other words, the farmers are not satisfied with the service offered by the extension agent as a knowledge and information provider. The results showed that the only determinants of the level of rice production are other sources of income, monthly income, and farm size. This implies that another source of income and monthly income provides more comfort and benefits, which motivates the farmers to work hard on their farms.

Additionally, a farmer with a bigger farm size is more likely to have better production since they can plant and cultivate more rice plants. Henceforth, the study recommended that the government support rice farmers in rural areas concerning their agricultural inputs, capital, training and seminars, and agricultural equipment, among others. Moreover, the local government must provide well-trained extension agents that disseminate new technologies and advance innovations to farmers to improve their knowledge and practices concerning improving their productivity in rice farming. It is highly suggested that for further studies, one may consider a survey on adopting new technologies in rice farming to supply and enrich the information of the current study.

6.0. Declaration of Conflict of Interest

No potential conflict of interest was reported by the authors.

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