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ANALYZING THE INFLUENCE OF FARMER FIELD SCHOOL (FFS) ON THE INCOME OF RICE FARMERS USING QUANTILE REGRESSION

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Abstract

This study looks into the influence of Farmer Field School (FFS) in enhancing rice farmers' income in Babatngon, Leyte, Philippines. The article also aimed to determine the significant factors that affect the rice income in the aspect of the rice production process under the FFS program. Secondary data were considered from the existing current study in the literature that dealt with rice farmers who finished their training in FFS. This study used some standard statistical measures to summarize and describe the data collected and employed quantile regression to capture the significant factors affecting the income of rice farming as influenced by FFS. The results of the survey depicted that the farmers who graduated with FFS training have high knowledge, positive attitude, and very great extent in their practices on what they have learned from crop management and the PalayCheck system. Based on the quantile regression models, the level of income in rice farming is influenced by a lower number of years in farming. This implies that younger farmers are more productive and efficient in enhancing their economic income since they are more competitive than traditional farmers. In addition, the regression models revealed that knowledge and attitude toward FFS do not influence their rice income unless it is implemented and adopted. Moreover, it is depicted that the practices of FFS farmers significantly influenced their level of income at a 10% level. Hence, FFS training has improved the productivity of farmers, and positively impacted their economic income and decision-making process. Furthermore, the study suggested that the FFS program must continually reach out to more small-scale farmers, especially in rural areas to attain sustainability in the country.

Key words**:** *rice farmers, farmer field school, PalayCheck system, profitability, quantile regression analysis*

INTRODUCTION

Rice (*Oryza sativa* L.) is a vital source of carbohydrates, essential fiber, and other nutrients. Apparently, rice farming in the Philippines is a source of staple food and income for many small-scale farmers especially in rural areas in the country [6], [7], [8]. In fact, rice production in the country has a huge contribution to the gross domestic product (GDP) and it is considered one of the sustainable crops in the agricultural sector [3]. In that case, the Philippine government aims to improve and enhance rice production in the country by supporting the farmers and giving them agricultural training and workshops. One of the implemented programs by the government is the Farmer Field School (FFS) which provides training programs for innovative technologies that enhance rice productivity in the country [21], [23].

The goal of the FFS organization is to improve the lives of farmers and move toward sustainable production methods and practices. This is done by educating the farmers to have a better knowledge of complex agricultural phenomena and enhancing the ecosystem services concerning farming [20], [27]. Moreover, the FFS objective is to provide hands-on learning that improves the skills and knowledge of farmers to sustainable management and improve their livelihoods which leads to better economic profitability [23] [28]. FFS also trains the farmers in decision-making and complex problem-solving in the farming system [26]. Plus, FFS is also promoting some environmental-friendly technologies that minimize the economic cost and resources [5]. In particular, the FFS training in rice farming introduces the various crop management areas from planting to harvesting [23]. FFS assess the rice farmers' progress concerning their practices in crop management and they provide new innovative techniques and technologies that enhance their production in season or out of

season. Moreover, FFS has helped farmers in pest control and management by adopting new integrated technologies through collective and experiential acquisition [14], [21]. In fact, FFS has an impact on the Philippine economy since farmers have learned the techniques in effective farming management that enhance their production and income [24]. On the face of it, it is vital to elucidate and provide a piece of the necessary information about the progress of farmers under the FFS training to improve the current policies. Additionally, an investigation of the FFS programs for farmers may give details on the effectiveness and constraints that can be used for policy formulation.

Although FFS in rice farming is well-research, research on the effectiveness of the rice farmers' income is relatively scarce. In addition, correlating the income of rice farmers to the knowledge, attitude, and practices that were influenced by FFS training using the quantile regression has never been done before. Hence, this article's research was realized to fill in the said gap. In general, the study elucidates the effect of FFS training on rice income through the knowledge, attitude, and practices of the farmers. Specifically, the article aims to provide an answer with the following agenda: (1) to summarize the farming profile of the FFS farmers; (2) to estimate the farmers' knowledge, attitude, and practices as influenced by FFS training; (3) to model the impact of FFS to the farmers' income via knowledge, attitude, and practices. The purpose of this article is to provide an understanding of the income level of farmers under the FFS training. Results may supply information on how to improve the farmers' income and productivity as well as well-being. Moreover, the findings may provide an argument that can be used to improve the weaknesses (if there are any) of FFS training and enhance the program that leads to sustainability and improving the skills and practices of farmers.

MATERIALS AND METHODS

The article's purpose is to create a statistical model that predicts the factors affecting the income level of rice farmers in the aspect of their farming profile, knowledge, attitude, and practices as influenced by FFS training. Hence, the study utilized a complex-correlational research design. Cross-sectional and secondary data were employed and analyzed through standard statistical measures and inferential statistics namely regression modeling analysis.

This article considered secondary and cross-sectional data from the current study by Red et al. [23] entitled “Effect of Farmer Field School (FFS) on the Knowledge, Attitude, Practices, and Profitability of Rice Farmers" which was published in the journal "Philippines Social Science Journal." The study dealt with a comparison test between FFS farmers and non-FFS farmers concerning their knowledge, attitude, practices, and profitability. However, the study does not develop a statistical model that determines the correlates of income incorporating the farming profile, knowledge, attitude, and practices as independent variables which were influenced by FFS training. The study was conducted at selected barangays in Babatngon, Leyte, Philippines namely Bagong Silang and Governor E. Jaro. Map 1 presents the location of Babatngon, Leyte.

Map 1. Location of Babatngon Leyte, Philippines
Source: [10].

These two barangays have a wide area for rice farming and they are beneficiaries of Farmer Field School (FFS) implemented by the

Department of Agriculture in the country. Hence, this study only dealt with farmers who already finish the FFS training. In that case, 47 FFS farmers were selected at random and considered as a participant in this research study. As for the data, the farming profile such as tenurial status (0 - non-owner, 1 - owner), number of years in farming, net income during the wet and dry seasons, and annual income (income during wet plus dry season) were employed. Note that these FFS farmers are cultivating a wide paddy farm of approximately 1.1 hectares for rice farming alone [23]. Plus, the knowledge, attitude, and practices towards the various crop management areas (PalayCheck System introduced by FFS). The PalayCheck System is a rice crop management that introduces innovative technology and practices in the different stages of rice farming that promote improvement in production, environmental safety, and economic profitability [9]. The PalayCheck system has the following 7 stages: (1) seed quality, (2) land preparation, (3) crop establishment, (4) nutrient management, (5) water management, (6) pest management, and (7) harvest management [23]. Note that in estimating the knowledge, attitude, and practices of rice farmers in the different crop management, a Likert scale was employed. Hence, Table 1 and 2 depicts the guidelines for possible perception scores for the knowledge, attitude, and practices of rice farmers and their linguistic interpretation.

Table 1. Knowledge and Practices level guidelines

Perception Score	Knowledge	Practices
1.00 – 1.80	Very low	Small extent
1.81 – 2.60	Low	Some extent
2.61 – 3.40	Moderate	Moderate extent
3.41 – 4.20	High	Great extent
4.21 – 5.00	Very High	Very great extent

Source: Author's guidelines (2023).

Table 2. Attitude level guidelines

Perception Score	Response	Attitude
1.00 – 1.83	Strongly disagree	Very negative
1.84 – 2.67	Disagree	Negative
2.68 – 3.50	Somewhat disagree	Somewhat negative
3.51 – 4.33	Somewhat agree	Somewhat positive
4.34 – 5.16	Agree	Positive
5.17 – 6.00	Strongly agree	Very positive

Source: Author's guidelines (2023).

After the data selection and clearing, the Microsoft excel form of the data was manipulated to fit it into STATA version 14.0 for statistical computation. In summarizing the selected data, frequency distribution, and percentages, mean (M), standard deviation (SD), minimum (min), and maximum (max) values were computed and interpreted. In addition, the computed descriptive measures were presented in tabular form. As for the determination of the significant factors (FFS influence) of the income level of rice farmers, a multiple linear regression was used as a piece of baseline information, and quantile regression was employed to analyze the predictors of the different levels of income. Multiple linear regression is a statistical modeling that deals with the relationship between a continuous dependent variable and continuous (or categorical) independent variables. In addition, linear regression uses the method of ordinary least squares (OLS) wherein it approximates the conditional mean average of the dependent variable [17]. Meanwhile, quantile regression approximates the conditional median (quantiles) of the dependent variable with respect to independent variables and it is often used when some assumptions of OLS are not being met. In [29], it is stated that quantile regression analysis provides a more rigorous statistical model than OLS regression. Whence, this article is well-grounded on the empirical regression model (Eq. 1) as follows:

$$Income_i = a_0 + a_1 tenurial_i + a_2 yearsfarm_i + a_3 knowledge_i + a_4 attitude_i + a_5 practices_i + e_i \quad \text{(Eq. 1)}$$

where $Income_i$ refers to the net income (annual income (wet+dry season)). Under the OLS regression, the conditional mean average for income was computed and under the quantile regression, conditional 25^{th} (low income), 50^{th} (middle income), and 75^{th} (high income) quantiles for income were approximated with respect to the independent variables. As for the independent variables, $tenurial_i$ refers to a dummy variable that captures a farmer who owned their cultivated

rice farm, $yearsfarm_i$ refers to the number of farmers' years of experience in rice farming, $knowledge_i$ refers to the farmers' knowledge perception score in the PalayCheck system as influenced by FFS, $attitude_i$ refers to the farmers' attitude perception score in the PalayCheck system as influenced by FFS, $practices_i$ refers to the farmers' practices perception score in the PalayCheck system as influenced by FFS, and $e_i$represents to the random error in the model (Eq. 1). Moreover, the OLS regression has undergone post-estimation (diagnostic) test to ensure the validity of the estimated parameters and all statistical results were tested at standard level of significance [17]. Furthermore, all computations were aided with the software called STATA version 14.0 and were all presented in tabular form and interpreted accordingly.

RESULTS AND DISCUSSIONS

Profile of Farmers

Table 3 showed that about 36% of the FFS farmers owned their rice land and does not pay for rent or lease. About 64% of these FFS farmers are just tenants for their cultivated rice land. This implies that they have to pay for leases and other expenses for the rice field. On average, the FFS farmers' number of years of experience in rice farming is close to 24.36 years. During the wet season, the FFS farmers' approximate income is close to 37,191.12 PHP (SD=10,545.68 PHP) ranging from 9,725 PHP to 55,870 PHP.

On the other hand, the dry season income for rice farming is close to 28,707.32 PHP (SD=8,995.12 PHP) which ranges from 7,470 PHP to 47,510 PHP. It is worth noting that rice is more productive in the wet season since they are best grown in good water level with continuous water irrigation, hence, income in the wet season is expected to be high as opposed to the dry season [13]. Furthermore, the annual income of FFS rice farmers is close to 65,898.45 PHP (SD=17,755.94 PHP) which ranges from 26,325 PHP to 98,200 PHP.

Table 3. Farming and income profile

Variable	M	SD	Min	Max
Tenurial status[a]	0.36	0.49	0	1
Years in farming	24.36	12.35	4	50
Wet season (income)[b]	37191.13	10545.68	9725	55870
Dry season (income)[b]	28707.32	8995.12	7470	47510
Annual income[b]	65898.45	17755.94	26325	98200

Note: a - dummy (indicator) variable; b - one cropping season (in PHP)
Source: Author's computations(2023).

Knowledge, Attitude, and Practices

Table 4 depicts that no farmers have graduated from FFS training with very low and low knowledge about rice crop management. Only 4.26% of them say that their knowledge is just moderate which indicates that the training successfully imparted information to the rice farmers. About 53.19% of the FFS farmers have learned and said that they have a piece of high knowledge. Moreover, 42.55% of them said that they possessed a very high knowledge of rice farming right after they graduated from the FFS training. As a whole, farmers are having a high knowledge (M=4.12, SD=0.48) of the PalayCheck system after their FFS training. In [16], it is depicted that knowledge and learning about the present innovative agricultural technology are vital in improving the farmers' yield and income through the adoption of the said crop management practices.

Table 4. Knowledge of FFS farmers

Knowledge	Frequency	Percent (%)
Very low	0	0.00
Low	0	0.00
Moderate	2	4.26
High	25	53.19
Very High	20	42.55
M±SD	**4.12±0.48 (High knowledge[a])**	

Note: a - See Table 1.
Source: Author's computations (2023).

As seen in Table 5, no FFS farmers have responded as "strongly disagree", "disagree", "somewhat disagree", or "somewhat agree" on their attitude about what they have learned about crop management principles. This indicates that they found their learning vital in improving their productivity. About 29.79% of them have agreed on the different PalayCheck which implies that they have a

positive perception score on crop management. Additionally, most (70.21) of them have a response of "strongly agree" on the PalayCheck system. Overall, the farmers are very positive (M=5.44, SD=0.49) to the new innovative technology in farming introduced by the FFS about crop management. The attitude and welfare of farmers towards the new agricultural technology and policies must be boosted through proper training so that they are more likely to adopt crop management programs in improving their farming techniques and efficiency [22].

Table 5. The attitude of FFS farmers

Response	Frequency	Percent (%)
Strongly disagree	0	0.00
Disagree	0	0.00
Somewhat disagree	0	0.00
Somewhat agree	0	0.00
Agree	14	29.79
Strongly agree	33	70.21
M±SD	**5.44±0.49 (Very positive[b])**	

Note: b - See Table 2.
Source: Author's computations (2023).

Table 6 presented that no farmers have small and some extent regarding their practices to the new FFS learning about rice crop management. Only 4.26% of the farmers have a moderate extent in their practices and about 38.30% of them have a great extent in practicing what they have learned in FFS training. Moreover, 57.45% of the farmers have a very great extent in their practices in which they have applied crop management to improve their production and economic income in rice farming.

Table 6. Practices of FFS farmers

Practices	Frequency	Percent (%)
Small extent	0	0.00
Some extent	0	0.00
Moderate extent	2	4.26
Great extent	18	38.30
Very great extent	27	57.45
M±SD	**4.24±0.44 (Very great extent[c])**	

Note: c - See Table 1.
Source: Author's computations (2023).

Overall, the FFS farmers' practices perception score can be interpreted as "very great extent (M=4.24, SD=0.44)." This implies that the farmers' practices are improved by FFS since the program involves long training and participatory activities [4]. In fact, if the farmers have high knowledge and a positive attitude about the newly introduce technology, they are more likely to practice it in their actual farming activities [16], [23].

Quantile Regression

Quantile regression models were presented in Table 7, consisting of the 25th (low net income), 50th (middle net income), and 75th (high net income) quantiles as dependent variables. The OLS model also was presented for comparison which dealt with average income in rice farming as the dependent variable in the regression. First, the diagnostics or post-estimation for the OLS model was bestowed to reveal if the results are valid for interpretation and forecasting. The Breusch-Pagan test showed that the OLS model is not heteroscedastic (X^2=0.29, p-value=0.59). Meaning, the model has more or less constant variances or does not vary significantly [17]. Using the concept of the Ramsey RESET test, the model was exposed that it does not possess an omitted variable bias (F=1.76, p-value=0.17), which indicates that independent variables were fitted and relevant as regressors. In addition, based on the variance inflation factor (VIF), it is shown that the OLS model does not possess a multicollinearity problem in which the mean VIF is equal to 1.39. This implies that there is no significant association between the found pairwise independent variables or predictors of the model [1].

Moreover, with the aid of the Shapiro-Wilk test, it is depicted that the OLS regression model has normally distributed residuals (W=0.98, p-value=0.90). The OLS model is significant at a 5% level (F=2.58, p-value=0.041) and has a coefficient of determination of 0.24. This indicates that there are significant predictors of net income in the model. In that case, the results of the OLS model are reliable for forecasting and interpretations as baseline information for the quantile regression models' results. Meanwhile, the quantile regression models has also significant predictors based on pseudo R^2 (25th quantile: R^2=0.179; 50th quantile: R^2=0.146; 75th quantile: R^2=0.105).

First, the quantile models and OLS model showed that income at all levels is not influenced by tenurial status. This means that being an owner of the rice field or being a tenant does not affect their economic income. This result is not parallel to [8], which stated that a farmer who owns their rice farm tends to have more income since they don't have to share or pay a lease. Secondly, the 25th quantile for the farmers' income model revealed that years in farming (a_2=-0.004, p-value<0.05) is a significant predictor of net income in rice farming.

Apparently, the negative coefficient indicates that a younger farmer tends to perform better as opposed to an older farmer concerning income generation. This result is supported by the OLS model, wherein the mean average income is significantly influenced by the number of years in farming. This means that for FFS graduates, younger farmers are more likely to learn and adopt innovative technologies nowadays compared to traditional farmers. Hence, rice production tends to be more successful for younger farmers due to the new application of agricultural technologies. In [18], it is mentioned that young farmers are more active and are more likely to diversify agricultural techniques than traditional farmers. Moreover, the 50th quantile regression model (a_2=-0.004, p-value<0.1) has revealed that income is influenced by younger farmers at a 10% level of significance. In fact, young farmers are having more opportunities to develop skills and are more competitive than old farmers [12]. Thirdly, knowledge and attitude in FFS towards cropping management do not influence their income in rice farming for both quantile models and the OLS model.

This means that farmers' learning and behavior in the FFS program do not help them in improving their production level and profitability in rice farming unless they put them into practice. Adoption of agricultural technologies can help solve the farmers' various problems in crop activities and enhance their efficiency which gives them relevant processes in effective farming principles [25]. The three quantile regression model (25th, 50th, and 75th) has revealed that their practices (coming from FFS learning) in crop management has influenced their income generation from rice production and it is significant at a 10% level. This is also true in the OLS regression model that the farmers' practices are significant causation to their economic income and similarly, it is significant at the 10% level. This implies that a farmer who implemented and adopted the teachings of FFS training has improved their level of production and efficiency in crop management regarding the PalayCheck system.

In [2], [23], and [24], it is mentioned that farmers who adopted innovative agricultural technologies have significantly increased their yield and productivity in rice farming and they tend to make better decisions in crop management activities as opposed to non-FFS farmers. Likewise, in [15], it is depicted that advanced technology in agriculture can easily progress the farmers' production in a smooth manner in which they have the motivation and a good decision-making process. Plus, the implementation and adoption of agricultural innovation technologies have a positive and significant impact on farmers' income and promote modernization in agriculture activities that is safety from the environment [11], [19].

Table 7. Quantile regression models for farmers' net income[b] and its determinants (FFS influenced).

Predictors	Quantile Regression Model			OLS Regression
	25th	***50th***	***75th***	
Constant	4.448*** (0.394)	4.274*** (0.300)	4.758*** (0.256)	4.447*** (0.236)
Tenurial status[a]	0.027ns (0.062)	0.031ns (0.060)	0.006ns (0.043)	0.023ns (0.040)
Years in farming	-0.004** (0.002)	-0.004* (0.003)	-0.001ns (0.002)	-0.003* (0.002)
Knowledge[c]	0.002ns (0.008)	0.002ns (0.006)	0.002ns (0.003)	0.006ns (0.005)
Attitude[c]	-0.007ns (0.011)	0.001ns (0.005)	-0.006ns (-0.236)	-0.003ns (0.006)
Practices[c]	0.018* (0.009)	0.016* (0.009)	0.011* (0.007)	0.011* (0.007)
n	47	47	47	47
F	-	-	-	2.58**
p-value	-	-	-	0.041
R^2	-	-	-	0.239
Psuedo R^2	0.179	0.146	0.105	-

Note: a - dummy (indicator) variable; b - one cropping season (in PHP); c - see Table 1 or 2; Standard errors are enclosed with parenthesis; ns - not significant; *p<10%; **p<5%; ***p<1%.
Source: Author's computations (2023).

CONCLUSIONS

The article's goal is to look into the influence of FFS training on rice farmers' income concerning knowledge, attitude, and practices. The descriptive measure results depicted that, on average, the rice farmers who finished the FFS training have high knowledge, positive attitude, and very great extent in their practices on what they have learned from crop management and the PalayCheck system. This goes to infer that FFS training has successfully educated the farmers on the new innovative technologies through actual and practical series of workshops in farm settings.

Based on the quantile regression models, the level of income in rice farming is significantly influenced by the lower number of years in rice farming. This implies that younger farmers are more productive and efficient in enhancing their profitability since they are more competitive and can easily learn than traditional or old farmers. In addition to that, the quantile regression models revealed that knowledge and attitude towards FFS do not influence their rice income unless it is being put into practice. Moreover, it is depicted that the practices of FFS farmers significantly influenced their level of income. This implies that the implementation and adoption of agricultural technologies can enhance their efficiency in farming and effectively manage their existing problems on the farm. Conclusively, the FFS training program has improved the productivity of rice farmers and positively influenced their economic income and decision-making process in the farming system. Therefore, it is highly recommended that FFS constituents must continually reach out to more small-scale or poor farmers in the country especially in rural areas to attain sustainability and productivity in rice farming. For future studies, one may consider a larger scale with a sufficient sample size of farmers to gather more sound information about the impact of FFS training on farmers' income. Furthermore, one may incorporate the subjective well-being of farmers about the FFS training as a possible factor of income level in the constructed regression model to strengthen the current results.

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