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Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 22, Issue 4, 2022
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ECONOMETRIC ANALYSIS ON RICE FARMERS' INCOME AS INFLUENCED BY EXTENSION AGENT'S ROLE

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Abstract

This article aimed to present the role of extension agents in improving rice farmers' income in Albuera, Leyte, Philippines. It also predicts the significant factors that influence the rice farmers' income to make policies that might improve the well-being of farmers as well as their rice production. Primary data were gathered through a developed structured questionnaire as a guide for a face-to-face interview of the sample farmers. The gathered data were summarized through some descriptive statistics and constructed an inference using econometric analysis in the form of a regression model. Results depicted that the average monthly income of rice farmers in Albuera, Leyte is close to 5,047.95 (₱) (SD=2,208.20 (₱)). On average, farmers' perception score towards extension agents' role revealed that they are "undecided" (Mean=3.28; SD=0.85) (score of 1 to 5) in regards to satisfaction. Additionally, the econometric model showed that farmer's ownership of the rice field (p-value=0.003), educational attainment of farmers (p-value=0.001), perception of farmers to extension agents as "organizers" (p-value=0.100), and perception of farmers to extension agent as "facilitator" (p-value=0.080) are the significant predictors of their monthly income. In conclusion, farmers in Albuera need assistance in regard to their agricultural production especially knowledge about new technologies and innovation to increase their economic profit. Hence, the study recommends that the Philippine local government must initiate organizing farmers' associations and cooperatives to address farmers' constraints and lack of agricultural training. Furthermore, the agricultural sector in the country must strengthen the agricultural extension agents by giving them proper training and education to effectively aid farmers.

Key words**:** *extension agent, small-scale rice farmers, monthly income, econometric analysis*

INTRODUCTION

The role of an agricultural extension agent is to improve the agricultural production process, develop education in agriculture, and progress farmers' income [24], [14]. In that case, sustainability in the agricultural aspect is expected to grow when an extension agent is continually providing the information and right knowledge for innovation. Hence, an extension agent is vital especially for small-scale farming to increase productivity. In the country Philippines, rice is the main staple food and source of income for Filipinos living in rural areas [5], [7]. And most of the rice farmers are low educated individual that needs proper guidance in the aspect of the farming system [3], [7]. The study of Casinillo and Seriño [7] revealed that farmers without enough knowledge and expertise in the government agricultural policy have a low happiness that affects their level of production. As a consequence, rice farmers' satisfaction and income are adversely affected by their low quality of well-being and lack of knowledge in agriculture [5], [23], [28]. On the face of it, the government must initiate agricultural programs and projects that will enhance productivity in farming through extension agents [8]. With this, non-educated farmers are guided and provided agricultural techniques to improve their capability in farming and increase profitability. In the study of Okwuokenye and Okoedo-Okojie [21], extension agents in agriculture have a primary concern about innovative technologies for farmers that will help them solve problems and amend existing techniques. In fact, agricultural extension is a kind of educational procedure that is fashioned for farmers to adopt improved technologies and practices [20], [30]. In that case, an extension agent is described as a tool in the carrying out of different agricultural projects [24], [14], [30].In other words, the main purpose of an extension agent is to impart educated

agricultural techniques that will sufficiently increase the production level and increase farmers' income [2].Apparently, in the study of Birkhaeuser et al. [3], it is stated that the extension agent has induced a great modification in the production and highlighted the value of an efficient transferral of advanced knowledge and new techniques to the farmers. Additionally, an agricultural extension agent can bridge the gap between discoveries in science laboratories and modification in the farmer's actual situation in the field [30], [3]. Extension agents' roles are the following [17]: (1) Educator - this refers to disseminating or transferring of information that brings about positive modification or benefits to farmers through pieces of training; (2) Mediator - this means that extension agents serve as a linker between agricultural researchers and actual farmers; (3) Organizer - this refers to a systematic planning and coordinating groups or associations to obtain a common goal which is agricultural productivity; (4) Facilitator - extension agents serve as a guide for farmers in facilitating their needs especially and addressing agricultural constraints; (5) Solution giver - this means that an extension agent must have enough knowledge and always been a source of information for farmers' existing problems in the production, and (6) Enabler - this refers to making the farmers being capable of coping the situations and achieving goals which are improving productivity. Shedding light on the level of rice farmers' income is well-researched, however, elucidating the role of extension agents as correlates of farmers' income is scarce in the body of knowledge. Additionally, predicting the factors (role of extension agents) affecting the farmers' income using an econometric analysis has never been done especially in the rural areas in the Philippines. Hence, this article constructed a regression model that determines the significant factors that influence the farmers' income in rice farming as influenced by extension agents. Specifically, the article provides an answer to the following objectives: (a) to describe the socio-economic profile of rice farmers in Albuera, Leyte, Philippines; (b) to find out causal factors that influence the rice farmers' income as governed by extension agents. The goal of this article is to supply new knowledge and policy that will improve the farmers' productivity and provide new information to amend the service of extension agents in the country.

MATERIALS AND METHODS

The location of this survey study is Barangay Poblacion, Albuera, Leyte, Philippines which is considered one of the large rice land areas in Albuera, Leyte. This site has a lot of paddy farmers that are reached out by extension agents. In that case, most of the farmers in the area are guided in regard to farming technologies and innovations. The survey only considered the small-scale farmers working with an average of 2 hectares of rice fields. Map 1 below displays the location of the survey study.

Map 1. Location of Albuera, Leyte, Philippines
Source: [13].

The research design applied to this study is a descriptive-correlational study where it applies some descriptive statistics to summarize the gathered information and constructs an econometric model to make an inference. In determining the number of participants, a sampling technique called simple random sampling was employed. As for the sample size, Slovin's formula was used as follows:

$$n = \frac{N}{1 + Ne^2} \quad \text{.....(1)}$$

where:

n – refers to the sample size, N – refers to the population size (all farmers that are reached out by an extension agent); and e – refers to the margin of error, the margin of error in this study is 5%. The sampling frame of all farmers was provided by the Municipal Agriculture Office (MAO) of Albuere, Leyte. Hence, this study considered 73 farmers in the Barangay to represent as participants of this study. Indeed, an ethical procedure was observed in the survey, a letter of permission was sent to the head of MAO, and participants were informed that the survey was voluntary and their response is highly confidential and solely used for this article only.

Concerning the survey questionnaire, it is developed structured type that was utilized to gather relevant information for this article. The said questionnaire is a guide for the interviewer for a face-to-face interview. The interview was done using the dialect of farmers in order for them to understand clearly and answer the questions accurately. The questionnaire contains the socio-demographic profile, the farmers' perception of the extension agents' role, and the farmers' monthly income in rice farming alone. For socio-demographic, captures the following: age of farmers (in years), sex of farmers (0-female, 1-male), education of farmers (0 - non-college graduate, 1 - college graduate), farm owner (0 - No, 1 - Yes). Additionally, the farmers must rate (perception score from 1 to 5) the following: (1) Educator, (2) Mediator, (3) Organizer, (4) Facilitator, (5) Solution giver, and (6) Enabler. Table 1 presents the guide for farmers' response to extension agents' roles.

Table 1. Scoring guidelines for extension agents' role

Interval perception scores	Verbal rating
1.00 – 1.80	Very unsatisfied
1.81 – 2.60	unsatisfied
2.61 – 3.40	Undecided
3.41 – 4.20	Satisfied
4.21 – 5.00	Very Satisfied

Source: Authors' own guidelines (2022).

Furthermore, economic profit (₱) in rice farming (one cropping season) was calculated as total revenue (₱) less total expense or cost (₱). Since one cropping season in rice farming will take place for about 4 months [27], then monthly income (₱) in rice farming is calculated as economic profit(₱) divided by 4. After the survey, the data gathered has undergone a clearing or removal of outliers (extreme response). In the data management, mean (M), standard deviation (SD), minimum (min), and maximum (max) value was computed as descriptive measures. Furthermore, an econometric regression model in the form of ordinary least squares (OLS)was constructed to acquire the significant factors of farmers' monthly income (dependent variable). The independent variables are the socio-demographic and farmers' perception to the extension agents' role. Thus, the empirical econometric model has the following form:

$$I_i = \partial_0 + \partial_1 age_i + \partial_2 male_i + \partial_3 educ_i + \partial_4 own_i + \partial_5 educator_i + \partial_6 mediator_i + \partial_7 organizer_i + \partial_8 facilatator_i + \partial_9 solution_i + \partial_{10} enabler_i + \epsilon_i \quad .....(2)$$

where:

I_i refers to the farmers' monthly income (₱), age_i refers to the farmers' age in years, $male_i$ refers to a dummy variable that captures male farmer, $educ_i$refers to a dummy variable that captures a farmer who is a college graduate, $educator_i$ refers to the farmers' perception score of an extension agent as an educator (Score of 1 to 5), $mediator_i$ refers to the farmers' perception score of an extension agent as a mediator (Score of 1 to 5), $organizer_i$ refers to the farmers' perception score of an extension agent as an organizer (Score of 1 to 5), $facilatator_i$ refers to the farmers' perception score of an extension agent as a facilitator (Score of 1 to 5), $solution_i$ refers to the farmers' perception score of an extension agent as a solution giver (Score of 1 to 5), $enabler_i$ refers to the farmers' perception score of an extension agent as an enabler (Score of 1 to 5), $\partial_t \forall t \in \{0, 1, \ldots, 10\}$refers to the parameters to be approximated and ϵ_i refers to the remaining random error in the model (1). STATA version 14 was used to obtain accurate calculations and diagnostic tests were also done to assure the validity of the model (1).

RESULTS AND DISCUSSIONS

Socio-demographic profile

In Table 2, it is revealed that the average age of rice farmers in Barangay Poblacion, Albuera, Leyte is close to 58 years old. The youngest is 36 and the oldest is 79 years old. This result is parallel to the findings of Casinillo and Seriño [7] that most rice farmers nowadays are mostly adults or older people since their young ones are sent to schooling to find decent work after. About 63% of these rice farmers are male and only 37% are female. It is worth noting that rice farming is a masculine job, hence, most are males who can manage this work well [4]. About 41% of these farmers own their rice fields and 59% are just tenant who cultivates the paddy farm with a rental fee to the landowner. This scenario is very common in the rural areas of Leyte, Philippines where most of the farmers are tenants rather than the owner of rice fields [4], [7]. Most (89%) of these farmers did not graduate with a bachelor's degree, hence, their knowledge used in farming is coming from their experiences. In that case, farmers of this type need guidance from extension agents [24], [14]. Moreover, the rice farmers' monthly income is about 5,047.95 pesos. The minimum is 3,000 and the maximum is 15,000 pesos. The rice farmers with high income are the one who applied innovative technologies in agriculture that improves their production [25]. In that case, to improve economic profitability in rice farming, farmers must be guided by an extension agent concerning their problems and constraint that need to be addressed [11], [19]. Hence, the right information in farming that is imparted by extension agents will lead to efficient productivity as well as the well-being of farmers.

Table 2. Farmers' profile

Variables	M ± SD	min	max
Age of farmers	57.79 ± 9.49	36	79
Male[a]	0.63 ± 0.49	0	1
Owner[a]	0.41 ± 0.49	0	1
Education[a]	0.11 ± 0.31	0	1
Monthly income[b]	5,047.95 ± 2,208.20	3,000	15,000

Note: a - dummy variable; b - Philippine Peso (₱);
Source: Own calculation based on data gathered (2022).

Extension Agents' Role

As seen in Table 3, farmers are satisfied with the extension agent as an "educator" (M=3.67, SD=0.75). This implies that the extension agent has imparted some useful knowledge to farmers concerning educational technologies in rice production and other post-harvest activities. This transfer of knowledge is done through training or seminars in the form of farmer field school (FFS) that influences their attitude and practices in farming [25]. In the first place, the role of the extension agent is to help farmers through educational means to improve their way of living and improve their economic income [16]. Secondly, the farmers are undecided about their perception of the extension agent as a "mediator"(M=2.85, SD=0.89). This implies that farmers cannot somehow see extension agents as an intermediary in developing communication systems with local organizations in their place. In other words, farmers are not satisfied with linking or coordinating services and promoting collaborationism with rural development stakeholders. According to Rivera [26], it is a responsibility of an extension agent to serve as a liaison between experts in agricultural sciences and local farmers.Farmers' perception towards the extension agent as an "organizer" is approximately satisfied (M=3.74, SD=0.88). In this case, extension agent is doing their duties as an arranger of events and other opportunities for economic development like cooperatives and training. It is stated in the book article of McDonnel et al. [18] that organizing cooperatives is very helpful for small-scale farmers to take advantage of economic and financial opportunities that might improve their entrepreneurial practices. Also, the extension agent as a "facilitator" is rated as satisfied (M=3.41, SD=0.88) by farmers. This indicates that an extension agent has facilitated the farmers in addressing the constraints and other problems in agricultural production and development. Daum and Birner [11], stated that farmers need extension agent that facilitates the needs in financial aspects concerning agricultural mechanization to improve efficiency in farming. However, farmers are undecided to their rating to an

extension agent as "solution giver" (M=3.37, SD=0.83) and "enabler" (M=2.63, SD=0.91). This implies that an extension agent cannot always solve the existing problems of a farmer concerning all aspects of agriculture-related. In addition, an extension agent does not always made his clients (farmers) capable of coping with the risks scenario to focus on their main goal which is economic profitability. According to Nakano et al. [19], it would have been effective if farmers are provided with a farmer-to-farmer extension program governed by extension agents to solve their problems in terms of technologies, financial aspects, output distribution (supply chain), and marketing, among others. Moreover, the farmers' overall perception of the extension agent is undecided (M=2.63, SD=0.91). This implies that the extension agent in their place must be strengthened and must be trained well to effectively function in their respective role. Farooq et al. [12], stated that extension agents must undergo an agricultural training course to disseminate innovative agriculture technologies and to construct policy suggestions for sustainable development.

Table 3. Farmers' perception of extension agents' role

Variables	M ± SD	Description[d]
Educator[c]	3.67 ± 0.75	Satisfied
Mediator[c]	2.85 ± 0.89	Undecided
Organizer[c]	3.74 ± 0.88	Satisfied
Facilitator[c]	3.41 ± 0.88	Satisfied
Solution giver[c]	3.37 ± 0.83	Undecided
Enabler[c]	2.63 ± 0.91	Undecided
Over-all	3.28 ± 0.85	Undecided

Note: c - Score of 1 to 5; d - See Table 1.
Source: Own calculation based on data gathered (2022).

Econometric analysis

Table 4depicts the different diagnostic tests for the OLS model to guarantee the validity of making an inference to the results. Firstly, the Breusch-Pagan test found that the OLS model is heteroscedastic (p-value<0.001). This means that the variances in the model are not constant and it needs to be corrected [15]. Hence, the model was rectified using the robust command in the STATA to arrive at homoscedasticity concerning the variances [6]. With the aid of the Ramsey RESET test, it is revealed that the model has no omitted variable bias and implies that the variables included in the model were appropriate and relevant as predictors (p-value=0.137) [10]. Moreover, the variance inflation factor (VIF) revealed that the econometric model does not suffer from multicollinearity problems which implies that no association was found in the pairwise correlation of predictors (VIF=1.51). This means that without the multicollinearity problem, no factor can undermine the statistical significance of a predictor [1]. Furthermore, by the Shapiro-Wilk test, it is revealed that the model has normal residuals, that is, normally distributed. This implies that the model's assumption is valid and will lead to a reliable inference and predictions of the results.

Table 4. Diagnostic tests

Test Statistic		p-value	Interpretation
Breusch-Pagan test	χ^2=8.41	0.004	Heteroscedasticity
Ramsey RESET test	F=1.92	0.137	No omitted variables bias
Variance inflation factor (VIF)	VIF=1.51	-	No Multicollinearity
Shapiro-Wilk test	Z=-1.190	0.883	Residuals are normal

Source: Own calculation based on data gathered (2022).

Table 5depicts that the created econometric model is significant (F_c=3.71, p-value<0.001) at a 1% α level. In fact, the coefficient of determination (goodness of fit, R^2=0.435) shows that the model has a better fit. This means that there are causal factors (demographic profile and extension agents' role) influencing the monthly income of rice farmers. However, the model reveals that the following variables does not influence the monthly income of farmers at 10% level (at most): (1) age of farmers (p-value=0.992), (2) sex of farmers (p-value=0.987), (3) perception of farmers to extension agent as "educator" (p-value=0.882); (4) perception of farmers to extension agent as "mediator" (p-value=0.640); (5) perception of farmers to extension agent as "solution giver" (p-value=0.570); and (6) perception of farmers to extension agent as "enabler" (p-value=0.789).
On the other hand, the model depicts that the following predictors are significant at a 10% α level (at most): (i) farmers own their rice

fields (p-value=0.003); (ii) educational attainment of farmers (p-value=0.001); (iii) perception of farmers to extension agent as "organizer" (p-value=0.100); and (iv) erception of farmers to extension agent as "facilitator" (p-value=0.080).

Table 5. An econometric model for farmers' monthly income and its causal factors.

Causal Factors of Monthly Income[b]	Econometric (OLS) Model		
	Coefficient	*Std. Error*	*p-value*
Constant	3.61756**	0.1242	<0.001
Age of farmers	-0.00002[ns]	0.0018	0.992
Male[a]	0.00059[ns]	0.0363	0.987
Owner[a]	0.10590**	0.0342	0.003
Education[a]	0.24968**	0.0684	0.001
Educator[c]	-0.00445[ns]	0.0298	0.882
Mediator[c]	-0.01077[ns]	0.0229	0.640
Organizer[c]	0.03423*	0.0217	0.100
Facilitator[c]	-0.0360*	0.0203	0.080
Solution giver[c]	0.0114[ns]	0.0199	0.570
Enabler[c]	-0.0038[ns]	0.0144	0.789
Observation	73		
F-computed	3.71		
p-value	<0.001		
Coefficient of determination (R^2)	0.435		

Note: a - dummy variable; b - Philippine Peso (₱); c - Score of 1 to 5; ns- not significant; * - significant at 10%α level; ** - highly significant at 1%α level.
Source: Own calculation based on data gathered (2022).

It is worth noting that if the farmer owns the paddy farm, then the farmer does not pay any more a rental fee for using the farm. In that case, the farmer only spends on agricultural inputs and labor expenses which indicates that owning a farm is a significant advantage as opposed to a tenant farmer. This result is consistent with the study of Casinillo and Seriño [7] which also found that farmers who own the farm are more likely happy or satisfied as a farmer. This is for the reason that the expense of rental fee for land is out of the equation for their profit computation.

Secondly, if the farmer is knowledgeable or educated they have a good attitude and practices in production. In fact, educated farmers are more capable of doing good farm management which will lead to better farming behavior which increases their profitability [25]. Moreover, farmers' education is a big help in understanding and finding the solution to the different problems in production. It also enhances their farm productivity by adopting the latest modern agricultural technologies [22].

Extension agent as "organizer" of farming and training activities has an impact on the farmers' monthly income. This means that a farmer who involves in the training gain additional knowledge on how to improve his farming skills. In addition, a farmer who is guided and supervised by an extension agent has an advantage because they are introduced to new innovative technologies that help to produce more rice yield. In fact, better interaction with a farmer and extension agent concerning with right information may help small-scale farmers in the acquisition of developing the living condition in farming [18], [9]. In that case, acquiring new knowledge in the farming system will enhance their ability to adopt new technologies which improve their rice production process as opposed to traditional ones. Moreover, organizing a farmers association will lead to a discussion of addressing the needs of farmers and problems encountered in farming. On the face of it, an extension agent can give a piece of advice and suggest a policy so that the government will support the farmers' concerns [16], [31].

On the contrary, the result of the model revealed that the extension agent as a facilitator has negatively impacted the rice farmers' income. This implies that the extension agent has not properly facilitated the farmer to their main goal which is economic profitability. This result is not consistent with the existing studies in the literature that extension agent is a great help to marginal farmers in rural areas [18], [19], [12], [9]. It is worth noting that an extension agent as a facilitator is one who educates and facilitates a group of farmers to work toward a common goal or objectives. Extension agent has the target of imparting to marginal farmers the quality of skill competence, and teamwork and facilitating them to increase productivity despite problems in agriculture. Likewise, an extension agent has the desire that a farmer must have a better understanding of climate science and its nature in agricultural management and practices [29].

CONCLUSIONS

Results revealed that the farmers' monthly income is below the poverty threshold in the country. This indicates that rice farmers in Albuera, Leyte must be guided and assisted by the Philippine government to somehow progress their economic income and well-being. On average, rice farmers' perception score towards extension agents can be interpreted as "undecided" concerning satisfaction. This can be concluded that they are not satisfied with the function of extension agents as an aid in increasing their productivity in rice farming. Conclusively, the government must support the farmers concerning their agricultural needs like machinery and equipment for farming. This can help farmers lessen their expenses from rice field cultivation to harvesting. Additionally, the agricultural sector and local government unit must support the farmers by providing them with a trained extension agent (well-educated) that will educate the farmers in adopting new technologies and innovations. These extension agents will organize farmers' associations that will conduct meetings or discussions regarding the farmers' constraints in production and provide a solution to their problems. The local government unit also must build cooperatives with the help of extension agents to address the farmers' needs in agricultural expenses and savings. In this regard, farmers may increase their productivity as well as their monthly income. The study suggests that a similar survey should be conducted with a large sample in other rural places of Leyte, Philippines to enrich the findings of this current article.

ACKNOWLEDGEMENTS

The author would like to give thanks to Herbert S. REBOJO and Virgelio C. DARGANTES Jr. for the data-gathering process.

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