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EFFECTS OF FARMER-ENTREPRENEURIAL COMPETENCIES ON THE LEVEL OF PRODUCTION AND TECHNICAL EFFICIENCY OF RICE FARMS IN LAGUNA, PHILIPPINES

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ABSTRACT

This study analyzed the effects of personal entrepreneurial competencies (PECs) on production and technical efficiency of rice farms in Laguna, Philippines. Forty farmers were randomly sampled and interviewed from May to July 2016. Descriptive, stochastic frontier production function, and regression analyses were performed. Majority (63%) of farmer-respondents were male, with average age of 54 years, average farming experience of 27 years, and average farm size of 2 ha. Majority (83%) was married with average household size of 5 and 65 percent were leaseholders. Results revealed that half of the respondents were weak opportunity seekers and had weak commitment to work contract, 43 percent were weakly persistent, and 32 percent had strong persistence competency. Only area cultivated significantly affected output during dry season, but area cultivated, labor, N-fertilizer, and seeds were significant factors of output in wet season. Farms were technically efficient during dry season but technically inefficient (technical efficiency of only 69.70%) during wet season. Generalized Linear Model of the binomial family with logit link showed that the dummies for "strong" level of competency for opportunity seeking, persistence, demand for quality and efficiency, risk-taking, information-seeking, systematic planning and monitoring, and self-confidence competencies were positive determinants of technical efficiency of farmer-respondents.

Keywords: entrepreneurship, personal entrepreneurial competencies, technical efficiency, generalized linear model with logit link

INTRODUCTION

Rice, the most important staple crop of Filipinos, continues to play a vital role in Philippine political economy, accounting for around 21% of Gross Value Added in agriculture (BAS, 2015), 3.5 percent of Gross Domestic Product (Intal, Jr. and Garcia, 2005), and employing 2.5 million households. These households are broken down into 2.1 million farmers, 110,000 workers for post-farm activities and 320,000 for additional activities (Gonzales, 2013 as cited by FAO, n.d.). The demand for this crop in the country crosses all social classes, with a high percentage of rural households depending upon the various stages of rice production as livelihood. However, their rice productivity is too low which leads to low income. The country's rice productivity in 2014 was 4.02 while China, Vietnam, and Indonesia yielded 6.81, 5.76, and 4.73 metric tons per hectare, respectively (USDA, n.d. as cited by IRRI, 2015). According to a study by Reyes, et. al., (2012), poverty incidence in 2009 among agricultural households (57%) is thrice that of the non-agricultural (17%). The share of *palay* (rice with husk) growers in the number of poor is the largest at 30 percent as compared to corn growing (17%), fishing (15%), and coconut growing (14%), while the headcount poverty rate among *palay* farmers is lower at 42 percent. Rice farmers in the country are traditional, in general. Traditional farmers are rational but risk-averse (reluctant to take risks) (Norton, et al. 2014). These farmers usually focus only on the availability of their production inputs like seed, fertilizer, pesticide among others, reducing opportunity for them to become competent entrepreneurs. Farmers usually miss out on prospects to farm as entrepreneurs due to their priorities such as their production tasks with some producing exclusively for home consumption (McElwee 2005).

Maintaining the robustness of economic and social status is one of the difficult tasks faced by rural communities, many of which are experiencing zero to low growth and development. Thus, rural community leaders foresee entrepreneurship as a solution as it creates new business enterprises with strong potential for increasing local economic activity. Government and private investors are interested in entrepreneurs, anticipating in them the element of growth that leads to innovation, success, job-creation and economic growth. Many small-scale farmers and extension organizations understand that there is little future for farmers unless they become more entrepreneurial in the way they run their farms.

An entrepreneur as “an idea man and a man of action who possesses the ability to inspire others, and who does not accept the boundaries of structured situations (Schumpeter 1949). He is a catalyst of change, instrumental in discovering new opportunities, which makes for the uniqueness of the entrepreneurial function”. Schumpeter (n.d.), as cited by Hall (2010), pinpointed entrepreneurship as the key creative force, talking in terms of a continuous process of disruption; doing something different for benefits; and creative destruction of the old to bring the new. It means being responsible for the marshalling of ideas, resources, people, processes, institutions and policy to affect new outcomes. Entrepreneurship is “the use of private initiatives to transform a simple business concept into a viable new enterprise. It could also involve diversifying an existing enterprise and encouraging it to grow.” (Kahan 2013)

It is important that entrepreneurs react with the environment proactively to minimize the negative effects of challenging business environments. Entrepreneurial competency has a critical role in taking such proactive approaches with the environment. Therefore, the role of an entrepreneur’s competency is a highly critical factor in achieving excellence in performance to ensure sustainable growth and success of a venture amidst a competitive business environment. The importance of entrepreneurial competency has increased during the past few decades due to the strategic role played by the human factor, particularly the entrepreneur of a business enterprise (Kochadai 2011). On the contrary, entrepreneurship is a new situation for many farmers (Bergevoet et al. 2005). There is still doubt if farmers have the capabilities for the entrepreneurial behavior needed, as they play an important role of being the sole labor force on the farm. Their responsibility is to combine the functions of the entrepreneur, manager, and craftsman in such a way that enables them to be successful. Success stories are likewise fueled by efficiency in doing business, be it a production, marketing, or purely service business. When it comes to production, the more frequent concern is technical efficiency. Technical efficiency refers to how productive a business can be given minimum resources necessary to do the job.

Meanwhile, it should be noted that the concept of entrepreneurship is not common to every culture or society. The fear of failure can also be a barrier (McElwee 2005). Traditional farmers usually do not want changes in their farming routines (Kahan 2013). Changes are considered as problems instead of opportunities, while entrepreneurial farmers usually use their confidence and their creativity to maximize and develop their ideas toward the attainment of goals. Entrepreneurship is not largely practiced or even promoted in rural areas and has been given relatively little emphasis in either agricultural or business literature. Empirical research on rural entrepreneurship is relatively scarce and this concept remains largely unknown, and even scarcer are the ones relating it to technical efficiency. A study therefore, on the effects of entrepreneurial competencies on the output and technical efficiency of rice farmers is vital. The study sought to determine the effects of entrepreneurial competencies on the output and technical efficiency of rice farms in Laguna, Philippines, a highly industrializing province but still rice-based.

RESEARCH METHODOLOGY

A total of 40 rice farmers from the remaining rice-based communities in the province of Laguna in the Philippines were randomly chosen and personally interviewed using a pretested interview schedule from May to July 2016. The lists of rice farmers were taken from their respective Municipal Agriculture Office (MAO). The interview schedule included questions on Personal Entrepreneurial Competencies (PEC), as developed by the UP Institute of Small-Scale Industries (UP-ISSI) and adopted from the Management Systems International (MSI) and McBer and Company. PEC questionnaire used 55 items to measure 10 PECs with different indicator questions. These PECs include opportunity seeking, persistence, committed to work contract, demand for quality/efficiency, risk-taking, goal-setting, information seeking, systematic planning and monitoring, persuasion and networking, and self-confidence (Diaz et al. 1997 as cited by Depositario, et al. 2011). PEC scores were interpreted using the following: 19 and above as strong; 16-18 as moderate; and 15 and below as weak.

STATA 10 by StataCorp was used to obtain the maximum likelihood estimates (MLE) of the production function parameters and frontier production functions (the technically feasible input-output relationship). In estimating the technical efficiency, the following stochastic production frontier function was used:

$$q_j = f(z_{ij}, \beta) + (v_j - u_j) \qquad \textit{Equation (1)}$$

where: q_j = quantity of output (mt/ha) of the j[th] farmer
z_{ij} = vector of capital inputs
β = vector of production coefficients to be estimated
v_j = random variability in the production that cannot be influenced by of the farmer
u_j = deviation from maximum potential output attributable to technical inefficiency

Generally, there are two models under the Stochastic Frontier Production that can be used in determining technical efficiency, the Cobb Douglas and the Transcendental Logarithmic (Translog) production frontier but the Cobb-Douglas model was used to analyze the input-output relationship in this study as indicated in the following equation:

$$lnq_j = \beta_0 + \sum_{i=0}^{5} \beta_i lnz_{ij} + (v_j - u_j) \qquad \textit{Equation (2)}$$

where: q_j = quantity of output (mt/ha) of the j[th] farmer
z_1 = area cultivated (ha)
z_2 = labor (mandays)
z_3 = nitrogen (kg)
z_4 = crop protection cost[2] (PhP)
z_5 = seeds (kg)
v_j = random error
u_j = error due to technical inefficiency

The generalized linear model for technical efficiency as affected by the ten PECs was expressed as:

$$\ell_n(\beta) = TE_j \cdot \log\left[G\left(\beta_{0n} + (\beta_{1n} \cdot PEC_{M_j}^{(n)}) + (\beta_{2n} \cdot PEC_{S_j}^{(n)})\right)\right] + (1 - TE_j) \cdot \log\left[1 - G\left(\beta_{0n} + (\beta_{1n} \cdot PEC_{M_j}^{(n)}) + (\beta_{2n} \cdot PEC_{S_j}^{(n)})\right)\right]$$

where:
TE_j = technical efficiency of j[th] farmer
G (·) = a known function satisfying 0 < G (z) < 1 for all Z ϵ ℝ

This ensures that the predicted values of y lie in the interval (0, 1).

${PEC_M}_j^{(1)}$= Moderate opportunity seeking dummy of j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(1)}$= Strong opportunity seeking dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(2)}$= Moderate persistence dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(2)}$= Strong persistence dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(3)}$= Moderate commitment to work contract dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(3)}$= Strong commitment to work contract dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(4)}$= Moderate demand for quality and efficiency dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(4)}$= Strong demand for quality and efficiency dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(5)}$= Moderate risk-taking dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(5)}$= Strong risk-taking dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(6)}$= Moderate goal-setting dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(6)}$= Strong goal-setting dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(7)}$= Moderate information seeking dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(7)}$= Strong information seeking dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(8)}$= Moderate systematic planning and monitoring dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(8)}$= Strong systematic planning and monitoring dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(9)}$= Moderate persuasion and networking dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(9)}$= Strong persuasion and networking dummy j[th] farmer
(1 = strong level and 0 = otherwise)

${PEC_M}_j^{(10)}$= Moderate self-confidence dummy j[th] farmer
(1 = moderate level and 0 = otherwise)

${PEC_S}_j^{(10)}$= Strong self-confidence dummy j[th] farmer
(1 = strong level and 0 = otherwise)

$b_i s$ are represented by the regression coefficients of the explanatory variables.

RESULTS AND DISCUSSION

Description of respondents. Majority (63%) of farmer-respondents were male, with average age of 54 years (34-76 years), average farming experience of 27 years (3-56 years), and average farm size of 2.71 ha which is quite higher than the country's average size of 1.14 ha (Tolentino 2015). Majority (83%) is married with average household size of five. Most of the respondents (33%) graduated tertiary level (e.g. dentist, doctor, and seaman) but still they prefer rice farming since their parents were also farmers from whom they inherited their existing rice farm. On the other hand, more than half of them (65%) were leaseholders only while 73 percent availed credit and had 15 training programs and seminars attended, on the average.

Personal entrepreneurial competencies (PECs) of rice farmers. In terms of personal entrepreneurial competencies, Table 1 shows that exactly half of the respondents were weak opportunity seekers. They do not reuse waste products from their harvests like rice straw and rice husks which can help in increasing profit, these were just burned. These were considered as a burden and not an opportunity to be innovative and resourceful.

Table 1. Distribution by personal entrepreneurial competency level, 40 rice farmer-respondents, Laguna, Philippines, 2015

Farmer Entrepreneurial Competency Level	Percent	Farmer Entrepreneurial Competency Level	Percent
Opportunity Seeking		*Goal Setting*	
Weak	50	Weak	40
Moderate	15	Moderate	35
Strong	35	Strong	25
Persistence		*Information Seeking*	
Weak	43	Weak	33
Moderate	25	Moderate	18
Strong	32	Strong	50
Commitment to work contract		*Systematic Planning and Monitoring*	
Weak	53	Weak	43
Moderate	23	Moderate	25
Strong	25	Strong	33
Demand for Quality/Efficiency		*Persuasion and Networking*	
Weak	45	Weak	58
Moderate	30	Moderate	13
Strong	25	Strong	30
Risk Taking		*Self-confidence*	
Weak	55	Weak	45
Moderate	18	Moderate	20
Strong	28	Strong	35

Forty-three percent of the respondents were weakly persistent and only 32 percent had strong persistence competency. Similarly, half of them had weak commitment to work contract. That is, they do not give time and effort and do not have enough courage to seek ways to maximize their profit. Many of these farmers just depended on their caretakers in managing their farms as they only visited their farms during the planting and harvesting seasons and seldom on the vegetative stage. Farmer-owners usually contributed only capital (without prior knowledge regarding what needs to be bought) and land while almost all labor is exerted by the caretakers and hired laborers. This is perhaps the result of the fact that the highest proportion of the farmer-owners (45%) had weak demand for quality and efficiency.

Having a large number dependent on their caretakers means that there is a possibility that they can be short-changed by the latter. In addition, since hired laborers and caretakers are wage-takers achieving the best quality of yield might not be a priority since they get paid whether the harvest is of high quality or not. Moreover, they tended to just imitate whatever a neighboring farm is doing without considering if it is applicable to their own farm. Such actions can lead to low yields which will lead to low profit, and sometimes, to incur some losses for the farm.

Risk seeking is rarely the case among farmers (Quilloy 2015). This is supported by the results of this study with findings that a higher proportion (55%) of the respondents have weak risk-taking competency (risk-averse). Risk averse pertains to someone who does not like the possibility for an undesirable event to occur. They are also, generally (40%) weak goal-setters. This might have been their response to the climatic conditions in the area which bring flooding, intense rain, or drought resulting to significant production losses. It should be noted that the Philippines is in the western rim of the Pacific, an area which is prone to extreme weather disturbances such as typhoons. On average, 8 or 9 tropical storms make landfall in the Philippines each year, with another 10 entering Philippine waters (Brown 2013). The eastern and southern portions of Laguna have no distinct seasons but experience distributed rainfall throughout the year. The study areas, however are among the flood-prone municipalities in the province due mainly to the increased water level of the Laguna Lake, overflowing of rivers, degraded watersheds, or due to urban runoff resulting from unsound developments in the area (Ardales et al. 2015). Even if rice is unique in that it can thrive in wet conditions where other crops fail, uncontrolled flooding is still a problem, because rice plants cannot survive if submerged in water for long periods of time (IRRI, n.d.).

On the other hand, half of the respondents were strong information seekers as supported by the fact that on the average, in 2015, they attended 15 training programs and seminars. Some of these were rice production training courses on *PalayCheck System*, farm machinery operation and safety, organic fertilizer production and utilization, soil analysis, techniques in fighting rice diseases caused by viruses, and technologies such as rice-mushroom and Carrageenan Plant Growth Promoter (PGP). *PalayCheck System* is a rice integrated crop management system for transplanted irrigated lowland rice farming. It integrates and balances relevant technology and crop management options with farmers' learning to improve productivity and profitability in an environment-friendly manner (Llanto et al. 2005).

Others also attended seminars about farm record keeping, effective water management, and basic microfinance while still others attended the "Radyo Program sa UPLB". Seminars attended other than rice farming include: garlic production and raising of sow, cattle, and goat. This information can help the farmers gain more knowledge and expand their farm business.

Forty-three percent (17) of the respondents had weak level of competency for systematic planning and monitoring. More than half (58%) of them had weak persuasion and networking competencies. This implies that the respondents are not good at establishing effective partnerships and relationships. For instance, they confessed that they do not know where to sell their produce at a higher price and do not have the motivation to influence their co-farmers about the knowledge and techniques that they have. Similarly, almost half (45%) of them had weak self-confidence. This can be linked with their low demand for quality and efficiency. There were however, a number (35%) who had strong self-confidence and moderately self-confident (20%).

Production and yield. The Philippines has two seasons for rice: wet and dry seasons. Wet-season rice crop in the north lasts from June to November and the dry-season crop from January to May-June. This is the season in Laguna. In the south it is the reverse: wet-season crops last from October-November to March-April and dry-season crops from May-June to November (FAO 2004). Table 2 shows that on the average, farmers produced 17.10 mt of *palay* during the dry season and a little lower during the wet season (14.35 mt). The good weather condition during summer months could have contributed to this difference. The greater radiation during ripening in dry season can contribute to the higher grain yield because of the greater biomass accumulation from flowering to physiological maturity during this period than in wet season. Higher grain yield in dry season could also partly be the result of greater spikelet production efficiency per unit biomass at flowering (Yang et al. 2008)

Table 2. Distribution by production and by season, 40 rice farmer-respondents, Laguna, Philippines, 2015

Production (mt)	Average		Dry Season		Wet Season	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
≤ 5	8	20	7	18	12	30
5.01 to 10	16	40	16	40	13	33
10.01 to 15	5	13	6	15	5	13
15.01 to 20	4	10	2	5	4	10
> 20	7	18	9	23	6	15
Total	40	100	40	100	40	100
Average	15.73		17.10		14.35	

In terms of yield, on the average, farmer-respondents had 5.54 mt per hectare (Table 3) which is much higher than the national average yield of 3.9 and 3.87 mt per hectare in 2015 and 2016, respectively (Countrystat PSA as cited by IRRI 2016).

Table 3. Distribution by yield (mt/ha) and by season, 40 rice farmer-respondents, Laguna, Philippines, 2015

Yield (mt/ha)	Average		Dry Season		Wet Season	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
≤ 4	7	18	9	23	13	33
4.01 to 6	16	40	12	30	16	40
6.01 to 8	16	40	11	28	10	25
> 8	1	3	8	20	1	3
Total	40	100	40	100	40	100
Average	5.54		6.07		5.01	

Input Utilization. Table 4 shows the average inputs used in rice production during dry season. Roughly 3 hectares of land were cultivated for rice by each farmer-respondent during dry season. Total amount of labor varied depending on tools and equipment used, land area planted to rice, and number of laborers. In this study, an average of about 345 man-days (one man-day is equivalent to eight hours of work) were allocated for the different activities in producing rice. The farmer-respondents used approximately 375 kg of nitrogen fertilizer, spent PhP12,596 for crop protection, and utilized 167 kg of seeds. For the wet season, the farmer-respondents cultivated same farm size as the dry season. However, they allocated slightly higher amount of labor (346 man-days) (Table 5). This is because *"hulip"* or plant replacement is commonly done in wet season when rice parcels are frequently flooded. In addition, the farmer-respondents used only 280 kg of nitrogen fertilizer in wet season, much lower than that of the dry season because during this time, rainwater is abundant. Rainwater contains nitrogen which can be readily absorbed by the rice plants. Crop protection cost and quantity of seeds utilized during wet season were almost the same with that of the dry season averaging PhP12,541 and 167 kg, respectively.

Table 4. Summary of descriptive statistics for inputs used, 40 rice farmer-respondents, Laguna, Philippines, dry season, 2015

Input	Mean	Standard Deviation	Maximum	Minimum
Area cultivated (ha)	2.71	2.82	12.00	0.70
Labor (man-day)	344.28	530.37	2670.00	63.13
N Fertilizer (kg)	374.93	435.13	2034.00	70.50
Cost of Crop protection (Php)	12,596.00	13,831.82	55,250.00	280.00
Seeds (kg)	166.76	203.99	960.00	15.00

Table 5. Summary of descriptive statistics for average inputs used, 40 rice farmer-respondents, Laguna, Philippines, wet season, 2015

Input	Mean	Minimum	Maximum	Standard Deviation
Area cultivated (ha)	2.71	0.70	12.00	2.82
Labor (man-day)	346.03	68.13	2,670.00	530.49
N Fertilizer (kg)	279.67	60.00	2,034.00	393.94
Crop protection's cost (Php)	12,541.38	280.00	55,250.00	13,890.23
Seeds (kg)	167.21	15.00	960.00	203.70

Production Function. There were five variables considered in estimating the production function: area cultivated, labor, N fertilizer, crop protection costs, and seeds. Crop protection cost was omitted due to presence of collinearity. It was revealed that only area cultivated significantly affected the output at 95 percent significance level (Table 6). Area cultivated had a positive coefficient which implies that every 10 percent increase in the land area, *cet. par.*, would result to 8.29 percent increase in rice production. As expected, increasing land utilization would increase rice production. The sum of all regression coefficients (significant and insignificant) is equated to production elasticity. With the sum of 1.04, in dry season, the stochastic frontier production function depicted increasing returns to scale suggesting that increasing the amount of all inputs by 1 percent will increase the output by 1.04 percent, holding other factors constant.

Table 6. Maximum likelihood estimates of the parameters of the stochastic frontier production function, 40 rice farmer-respondents, Laguna, Philippines, dry season, 2015

Variable	Coefficient	Standard Error	Z-Value	P-Value
Constant	0.553	1.231	0.45	0.653
z_1 Area cultivated (ha)	0.829**	0.240	3.45	0.001
z_2 Labor (man-days)	-0.009	0.132	-0.07	0.944
z_3 N-Fertilizer (kg)	0.340	0.213	1.60	0.110
z_5 Seeds (kg)	-0.117	0.078	-1.49	0.135
Returns to scale	1.042			
Log likelihood	-17.520			

** significant at 5% probability level

On the other hand, for wet season, it was revealed that at 1 percent level of probability, every 10 percent increase in the area cultivated, *cet. par.*, would result in 9.15 percent increase in the total volume of rice produced. Similarly, the amount of nitrogen fertilizer is a positive determinant of rice production at 1 percent level of probability. This means that a 10 percent increase in the amount of nitrogen fertilizer, *cet. par.*, would result to 5.69 percent increase in rice production (Table 7). Nitrogen promotes rapid plant growth and improves grain yield and quality through higher tillering, leaf area development, grain formation, grain filling, and protein synthesis. It is highly mobile within the plant and soil (Rice Knowledge Bank, n.d.).

Table 7. Maximum likelihood estimates of the parameters of the stochastic frontier production function, 40 rice farmer-respondents, Laguna, Philippines, wet season, 2015.

	Variable	Coefficient	Standard Error	z-Value	P-Value
	Constant	1.731	0.067	25.97	0.000
z_1	Area cultivated (ha)	0.915***	0.108	8.51	0.000
z_2	Labor (man-days)	-0.359***	0.114	-3.14	0.002
z_3	N-Fertilizer (kg)	0.569***	0.040	14.27	0.000
z_5	Seeds (kg)	-0.166***	0.054	-3.10	0.002
Returns to scale		0.959			
Log likelihood		-6.124			

***significant at 1% probability level

However, labor, while significant at 1 percent level of probability, had a negative sign. This indicates that a 10 percent increase in labor, *cet. par.,* would result to 3.59 percent decrease in rice production. This has implication in the labor efficiency of workers and can also be linked to the fact that there were many farmers who depended only on their caretakers for farm operations. Since hired laborers and caretakers are wage-takers, they do not have enough incentive to improve the quality of their work, adversely affecting yield.

Quantity of seeds was also significant but with a negative relationship to production at 1 percent level of probability. Coefficient implies that a 10 percent increase in the quantity of seeds, *cet. par.*, would result to a 1.66 percent decrease in rice production. This could be attributed to improper transplanting of seedlings which lead to their overuse. Farmers believe that increasing the quantity of seeds would increase production thus, tended to transplant bunches of seedlings with the aim of increasing the yield. However, according to the Rice Knowledge Bank of IRRI (n.d.), transplanting requires less seed but much more labor compared to direct seeding. A lot of farmer-respondents did the straight-row method of transplanting. In this method, only two to three seedlings of 15–21 days, wet-bed or dry-bed, grown seedlings should be transplanted at 20 x 20 cm spacing. During this stage, hired laborers have the tendency to speed up their work (since it is on *pakyawan* or contract labor), therefore, the number of seedlings to be transplanted is generally neglected by them. They transplant four or more seedlings which can affect the production of rice negatively as the recommended spacing was not followed.

Unlike in the dry season, during wet season, the stochastic frontier production function with the sum of regression coefficients amounting 0.959, was found to depict decreasing returns to scale. This suggests that increasing the amount of all inputs by 10 percent will increase the output by 9.6 percent, holding other factors constant.

Technical efficiency level. Technical efficiency is the deviation of the average production function from the frontier production function. It is the ratio of the actual production and potential production for a given set of inputs and technology (Quilloy 2015). Only wet season was considered since it is during this season that the farmer-respondents experienced low production level and therefore, necessitates further analysis for improvement. Rice production was found to be 30.30 percent technically inefficient during wet season since the weighted mean technical efficiency was 69.70 percent and only four farms were found technically efficient. The most number of farms (18% each) were 50 to 59 and 90 to 99 percent technically efficient. One farmer got technical efficiency level ranging from 10 to 19 percent, the lowest recorded in this study (Table 8).

Table 8. Distribution by technical efficiency level, 40 rice farmer-respondents, Philippines, wet season, 2015

Technical Efficiency (%)	Percent	Technical Efficiency (%)	Percent
10 to 19	3	60 to 69	13
20 to 29	0	70 to 79	13
30 to 39	10	80 to 89	13
40 to 49	5	90 to 99	18
50 to 59	18	100	10
Minimum		17.90	
Maximum		100	
Mean		69.70	

Effects of entrepreneurial competencies on technical efficiency. Again, in view of the fact that during dry season, the farms were technically efficient, thus less variability, it was deemed more critical to consider the wet season parameters in determining the effects of entrepreneurial competencies on technical efficiency. This is to better understand what needs to be done for future improvement of the area's rice industry. The General Linear Model (GLM)of the binomial family with the logit link was used for this purpose. Results revealed that opportunity-seeking, demand for quality and efficiency, information-seeking, persistence, risk-taking, systematic planning and monitoring, and self-confidence were significant factors of technical efficiency (Table 9). The dummy variables for "strong" in opportunity seeking, demand for quality and efficiency, and information-seeking competencies are significant determinants of technical efficiency at 10 percent probability levels. These figures suggest that if the abilities/attitudes of the farmers can be improved for them to become strong in these competencies, the technical efficiency of their rice farms can be increased by 0.25, 0.25, 0.29, respectively, holding other things constant. In addition, the dummy variables for "strong" in persistence, risk-taking, systematic planning and monitoring, and self-confidence competencies are significant at 5 percent level of probability and had positive signs. Similarly, values obtained implies that by cultivating these competencies from weak to strong, technical efficiency of the rice farms can be increased by 0.31, 0.27, 0.27, and 0.30, *respectively,* holding other things constant.

Table 9. Effects of PECs on technical efficiencies using GLM with logit link, 40 rice farmer-respondents, Laguna, Philippines, wet season, 2015

Variable		DY/DX	Standard Error	Z-Value	P-Value
Opportunity seeking					
$PEC_{M_j}^{(1)}$	Moderate dummy	0.070	0.178	0.40	0.691
$PEC_{S_j}^{(1)}$	Strong dummy	0.250*	0.137	1.83	0.067
Predicted mean			0.715		

Variable		DY/DX	Standard Error	Z-Value	P-Value
Demand for quality and efficiency					
$PEC_{M_j}^{(2)}$	Moderate dummy	0.206	0.135	1.53	0.127
$PEC_{S_j}^{(2)}$	Strong dummy	0.252*	0.130	1.94	0.053
Predicted mean			0.716		
Information-seeking					
$PEC_{M_j}^{(3)}$	Moderate dummy	0.111	0.164	0.68	0.498
$PEC_{S_j}^{(3)}$	Strong dummy	0.289*	0.150	1.92	0.055
Predicted mean		0.715			
Persistence					
$PEC_{M_j}^{(4)}$	Moderate dummy	0.095	0.146	0.65	0.517
$PEC_{S_j}^{(4)}$	Strong dummy	0.310**	0.129	2.41	0.016
Predicted mean			0.726		
Risk-taking					
$PEC_{M_j}^{(5)}$	Moderate dummy	0.132	0.153	0.86	0.388
$PEC_{S_j}^{(5)}$	Strong dummy	0.273**	0.129	2.12	0.034
Predicted mean		0.720			
Systematic planning and monitoring					
$PEC_{M_j}^{(6)}$	Moderate dummy	0.143	0.144	0.99	0.321
$PEC_{S_j}^{(6)}$	Strong dummy	0.270**	0.134	2.01	0.044
Predicted mean		0.716			
Self-confidence					
$PEC_{M_j}^{(7)}$	Moderate dummy	0.085	0.156	0.55	0.586
$PEC_{S_j}^{(7)}$	Strong dummy	0.296**	0.132	2.24	0.025
Predicted mean		0.723			

***, **, and * denote significance at 1%, 5%, and 10% probability levels, respectively.

CONCLUSIONS AND RECOMMENDATIONS

Generally, the farmer-respondents have weak opportunity seeking, persistence, commitment to work contract, demand for quality/efficiency, risk taking, goal setting, and systematic planning and monitoring competencies but they have strong information seeking competency. Rice production was technically efficient during the dry season but inefficient during wet season. In view of these conclusions and other research findings, the following are recommended:

Continued provision of more and new information on rice farming. Aside from seminars, carefully planned tours may also help farmers gain new knowledge and see markets first-hand, visit input suppliers and buyers, and make contacts. Farmers' visits to other farms allow exchange of experiences which will improve their competencies for enhanced rice farming technical efficiency. Those who have wrong misconceptions about proper rice farming practices, which contribute to low yield, could learn from those performing best practices.

Farm Business School should be made available and accessible to more farmers. Participation in training courses requires considerable motivation on the part of a farmer to consider attending a formal training course. Courses take up valuable time and farmers need encouragement and incentives to participate. Farm Business School (FBS) is a curriculum-based approach to extension aimed at building farmers' entrepreneurial capacity (Kahan 2013). Learning takes place in the context of the participants' farming businesses through schools set up at community level. It helps farmers learn how to make their farming enterprises and operations profitable and-responsive to market demands.

Improving the entrepreneurial competencies of rice farmers. One of the immediate solutions to remedy the weak entrepreneurial competencies of the farmers is equipping the rice extension workers with knowledge on how to improve these competencies. Extension workers bridge the gap between the technocrats and the farmers because most of them are technically-trained but they too lack formal training on entrepreneurship. Their role is crucial in assisting and getting farmers to reflect on their business performance and help them implement their learning,

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