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Factors Influencing the Rice Production of Farmers in Rural South-Eastern Cambodia

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ABSTRACT

This study attempts to explore the factors affecting rice production in rural south-eastern Cambodia. Data applied in this study was obtained from the household survey in rural farmers. It was conducted in three provinces of Cambodia namely; Takeo, Kandal and Kompong Speu from which, 240 households are randomly selected based on the regulation and sample distribution. The estimated parameters were computed by the Cobb-Douglas production function revealed that seed, fertilizer, herbicides, family size, and income off-farm were significant and a major determinant in the wet season paddy output. In similarly, fertilizer, pesticides, transportation, and income off-farm jobs were significant at 1% level, and irrigation, household labor, and family size were significant at 5% and 10% level, respectively. When a 1% increase rice inputs would increase rice output by 0.69%, 0.17%, 0.51%, 0.08%, 0.09%, 0.04%, 0.76%, 0.21% and 0.41% for seed, fertilizer, pesticide, household labor, hired labor, irrigation, transportation, family

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size, and income off-farm jobs, respectively in dry season, while wet season would increase by 0.072%, 0.259%, 0.043%, and 0.049% respectively for seed, fertilizer, herbicides and family size. Furthermore, the deficiency of high-quality varieties and other inputs are included lack of capital, lack of technology, lack of researcher or technician and development institutions to improve rice production efficiency and market information in Cambodia are challenges of household farmers to increase rice productivities and income generation.

Keywords: Rice production, Cobb-Douglas production function, South-eastern Cambodia.

INTRODUCTION

Rice is Cambodia's staple food, the leading crop and a valuable source of income for 85 percent of rural households. It contributes to approximately 4.5% of GDP, 20% of the total family income, and the rice revenue accounts for more than 50% of gross domestic product (CDRI, 2017). Income from crops has increased annually as a result of yield increase, and due to increased yields, the crop costs are high. The rapid poverty reduction in rural areas, from 59% in 2004 to 24% in 2011, was driven by higher rice prices, high rice production, high returns from non-farm businesses, high rural salaries and job growth in urban areas. Almost half of the poverty reduction is directly attributable to high prices (24 percent) and rice production (23 percent) (Sothy et al. 2017). Rice production alone accounted for half of the total crop production and grew significantly from about 1.7 million tons in 1980 to 9.3 million tons in 2015. Cultivated varieties include traditional non-aromatic rice, IR rice (mostly dry season paddy) and fragment rice (wet season paddy). Official statistics are scarce. However, it is currently estimated that the IR varieties account for about one-quarter to one-third of the total output. From 1980 to 1992, most agriculture fields were rice fields. Dry season rice production began to increase in 1994, up from just 0.4 million tons in 1980 to 2.2 million tons in 2015, equivalent to 23% of total paddy production (AuAid and World Bank, 2012). Furthermore, the key inputs of rice production are seeds, fertilizers, pesticides, insecticides, farmland, and hired labor, and some may

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include irrigation infrastructure and machinery rentals. Early rice varieties are demanded the most in kilograms per hectare, while the late maturing rice is requested at the lowest demand. Similarly, those farmers used the highest amounts of basal fertilizer. The use of fertilizers is remarkably high in short-term farming compared to medium- and long-term agriculture. Farmers can not estimate the exact amount of agricultural pesticides they have applied to their fields. However, they were reminded of the higher spending on short-term rice (CDRI, 2017).

In addition, the total agricultural land has grown over the past 10 years. Cultivated rice expanded from 3.052 million hectares in 2013 to 3.055 million hectares in 2014. The cultivation of dry season rice amplified from 0.485 million to 0.491 million hectares. Nevertheless, it diminished from 2,568 to 2,565 million hectares during the wet season. Between 2004 and 2014, the average rice output increased from 2.0 tons/hectare to 3.1 tons/hectare. The average yield in 2014 is seasonally adjusted and the output in the wet season decreases from 2.9 to 2.8 tons/ha, but it had amplified from 2.3 tons/ha in 2011 and for 2013 from 4.38 to 4.44 tons/ha during the dry season (MAFF, 2015a). Agricultural crop in the dry season is very productive depending on irrigation, use of high yield varieties, fertilizers and high commitment in management (Yu and Fan, 2009). According to the Ministry of Agriculture, Forestry and Fisheries in 2015b, the decline is due to climate change, especially drought. Drought-damaged areas have been calculated to approximately 20.06 hectares, the highest in five years (Bansok et al. 2011). Rice output in the rainy season has increased every year from 2004 to 2013, but in 2014, it declined to 7.1 million tons from 7.27 million tons in 2013. The rice production in dry season augmented from 1.04 million tons in 2004 to 2.18 million tons in 2014 due to expanding the cultured region and improved output. For floating rice yield, it surged in 2008 (98,116 tons), but dwindled for six years (2009-2014). In 2014, only 52,539 tons of floating rice was produced. The reduction by half is due to changes in the natural floods and the construction of hydropower dams and reservoirs (MAFF, 2015a).

In this study, we attempt to contribute to analyzing the rice inputs in the dry season to improve rice yields in farming households of Cambodia as a policy

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instrument to develop rural areas. Amongst the farming households operating in the southeast region of Cambodia are; Takeo, Kandal and Kampong Speu provinces. The aim of this study is to analyze inputs of dry season rice production and to determine the main factors influencing the growth in rice yield and productivity. The information gathered might be useful to rice farmers and as well as for policymakers of the government and related parties for improving Cambodian rice production. The rest of this paper is divided into five sections. Following the introduction are the research methodology, data and description, results and discussion and conclusion.

MATERIALS AND METHODS

Empirical model

The study carried out the Cobb-Douglas production function, using STATA software to analyze the significant factors of input in dry season rice yield. The research used Cobb-Douglas production function including the study of new production function with technological innovation in China by Qian et al. 2010, Tun et al. 2015 analysis of the factors affecting rice production efficiency in Myanmar, the study of analysis of rice production and contributions to Cambodian economic growth by (Nhat et al. 2015), the study on comparative study on factors influencing rice yield in Niger State of Nigeria and Hainan of China by Ahmed, et al. 2017, Jermy et al. 2011 researched on does input quality drive measured differences in firm productivity, the study on determinants of rice productivity and technical efficiency in the Philippines by Koirala et al. 2014, Budiono et al. 2017 researched on efficiency analysis of production factors utilization in upland rice farming in Indonesia, the study on analysis of technical efficiency for household's rice production in Cambodia by Sokvibol et al. 2016, the study on measurement of efficiency of Cobb-Douglas production function with additive and multiplicative errors in Bangladesh by Hossina et al. 2015, Khai and Yabe, 2011 the study on technical efficiency analysis of rice production in Vietnam, the study on the influences of production factors with profit on agricultural heritage system in China by Liu et al. 2017, the study on use of Cobb-

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Douglas production function model on some selected manufacturing industries in Oman by Hossain et al 2010. There has been no study on the factors affecting dry season rice yield yet. Therefore, the study will contribute to increasing rice production in Cambodia.

In the study, the Cobb-Douglas production function was applied as follow:

$$Y = AK^{\beta 1}L^{\beta 2} \quad (1)$$

Where:

• Y = the total output of certain crop at the time

• L = labor input (the total number of person-hours worked at the time)

• K = capital input (seed, fertilizer, pesticide, weedicide, irrigation, transportation at time)

• A = is constant

• β1 & β2 are coefficient to be estimated of labor and capital, respectively

Equation (1) is nearly always treated as a linear relationship by making a logarithm transformation, which yield:

$$\ln Y = \ln A + \beta_1 \ln K + \beta_2 \ln L \quad (2)$$

According to equation (2) with independent variables L and K to i become:

$$\ln Y = \beta_0 + \beta_1 \ln K + \beta_2 \ln L + \cdots + \beta_i \ln X \quad (3)$$

And decoding equation (3) according to this study we have:

$$\ln Y_{dr} = \beta_0 + \beta_1 \ln seed_{dr} + \beta_2 \ln fert_{dr} + \beta_3 \ln pest_{dr} + \beta_4 \ln herb_{dr} + \beta_5 dummyirri + \beta_6 \ln house_{dr} + \beta_7 \ln hired_{dr} + \beta_8 \ln tran_{dr} + \beta_9 \ln age + \beta_{10} \ln family + \beta_{11} \ln edu + \beta_{12} \ln income + \varepsilon_i \quad (4)$$

$$\ln Y_{we} = \beta_0 + \beta_1 \ln seed_{we} + \beta_2 \ln fert_{we} + \beta_3 \ln pest_{we} + \beta_4 \ln weed_{we} + \beta_5 \ln hom + \beta_6 \ln hired + \beta_7 \ln age + \beta_8 \ln family + \beta_9 \ln edu + \beta_{10} \ln income + \varepsilon_i \quad (5)$$

Where,

- $\ln Y_{dr}$: logarithm of rice yield per hectare in the dry season
- $\ln Y_{we}$: logarithm of rice yield per hectare in the wet season
- lnseed : logarithm of seed
- lnfert : logarithm of fertilizer

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- lnpest : logarithm of pesticide
- lnherb : logarithm of herbicide
- dummyirri : dummy of irrigation
- lnhouse : logarithm of household labor
- lnhired : logarithm of hired labor
- lntran : logarithm of transportation
- lnage : logarithm of the age of household head
- lnfamily : logarithm of family size
- lnedu : logarithm of education of household head
- lnincome : logarithm of income off-farm
- ε_i : error terms

The coefficient $\beta_1, \beta_2, \beta_3,\ldots, \beta_i$ are the elasticity yield with respect to input L, K,…and X. The sum of elasticity $\beta_1 + \beta_2 + \beta_3 + \cdots + \beta_{i,}$ provides the returns to scale of the farms in question. It means if: $\beta_1 + \beta_2 + \beta_3 + \cdots + \beta_{i,} = 1$, the production operates under constants returns to scale.

$\beta_1 + \beta_2 + \beta_3 + \cdots + \beta_{i,} > 1$, the production operates under increasing returns to scale.

$\beta_1 + \beta_2 + \beta_3 + \cdots + \beta_{i,} < 1$, the production operates under decreasing returns to scale.

Data Description

The data analyzed in this study was obtained through a household survey conducted in 2018 from the three stated provinces in Cambodia. Random sampling was done through which 240 farmer households were randomly selected. The authors lead data collection and were accompanied by some postgraduate students from AII-CAAS, graduate students from Regional Polytechnics Institute Techo Sen Takeo (RPITT) and from the University of Management and Economics (UME). The data collection has covered several aspects of the rural farmers encompassing household conditions, income from farming, daily expenditure, inputs of rice production and agricultural technology information.

The data collection was preceded by contacting the local authorities (chiefs of the ward, commune, and village) and then conducting a face-to-face interview with farming households and stakeholders. The inputs of rice paddy are including seeds, pesticides, herbicides, fertilizer, irrigation, household labor, hired labor, transportation, and others. Because the increased rice inputs affected the wet season rice, the dry season rice production had increased yield to about 7.637 million tons and 2.315 million tons respectively in 2016. The increase in rice production is mainly due to the support offered by the Royal Government of Cambodia, relevant ministries and institutions, development partners, national and international organizations, sub-national authorities and farmer participation.

Based on our research, only farming households were selected for analysis. Mixed farmers, paddy producers, and other crops are not included in the data to be analyzed so that to ensure bias in sample options is minimized. Data modification and filtering are performed to ensure that the unit of measure of each variable is consistent with the academic goals and the quality of the data is satisfactory.

RESULTS AND DISCUSSION

Summary Statistics

The statistics summary of variables in rice inputs and outputs used in estimating the regression model (refer to Table 1). The table includes; seed, pesticides, weedicides, fertilizer, irrigation, household labor, hired labor and transportation. The household characteristics encompass; the age of household head, family size, education of household head and income off-farm job of a head household. The mean, standard deviation, the minimum and the maximum value of each variable is shown in the table as followed; on the average, the rice yield was about 4977 kilograms per hectare, the maximum and minimum were around 6374 kilograms and 2080 kilogram respectively. The estimated yield of 3996 kilograms is needed for standard deviation. Yu and Fan (2007) researched on rice production response in Cambodia, it showed that the average paddy yield of the dry season was about 3600 kilograms per hectare, so from 2007 to 2017paddy yield of dry season rice increased to around 1377 kilograms.

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On average around 234 kilograms per hectare of seeds were used, the maximum is 420 kilograms of seed per hectare and the minimum is roughly 250 kilograms of seed per hectare. Cambodia Agriculture Value Chain Program (CAVAC) 2016 found that Cambodian farmers used an average of 230 kilograms of seeds per hectare for the dry season and 134 kilograms of seeds per hectare for the wet season and other farmers used up to 400kilograms of seed per hectare. Meanwhile, Sothy et al. (2017) found that the early rice varieties required 322.1 kilograms of seeds per hectare and 122.2 kilograms of seeds for late rice. On the other hand, the average of pesticides applied is around 4472 ml/ha, the maximum application is 6500 ml/ha in dry season rice, and the average of weedicides used is 2165 ml/ha, while the maximum approximates to 2400ml/ha in the output of dry season rice. The World Bank (2015) and Dary et al. (2017) exposed that most of the Cambodian farmer's use of pesticides on crops and vegetables is surging. Consequently, farmers used pesticides on vegetables higher than pesticides on rice. In addition, in 2013, the cost of farmer’s expenditure on pesticides was 12 dollars per hectare for dry season rice and the use of weedicides was also increasing. Weed destruction is a significant obstacle to large-scale farming, especially in the upland regions. The farmers that produce cassava and maize use higher application of weedicides compared to rice production.

The average application of fertilizer was around 269 kilograms per hectare of dry season rice; the maximum is approximately 500 kilograms per hectare, and the minimum is 100 kilograms per hectare. The result illustrated that the farmers used more fertilizer compared to the research of Theng et al. (2014) and Dary et al. (2017), (in 2013, farmers used 153kg /ha during the dry season and only 66kg/ha during the wet season). However, in the upland areas, the rice cultivation of the wet season is shifting cultivation, so farmers use small quantities of fertilizer during the dry season and the use of fertilizer varies depending on its price. The kind of crops farmed along the Mekong regions uses more fertilizer than the other areas. The average irrigation infrastructure was approximated 64 percentages for the dry season paddy. According to the Cambodia Development Research Institute (2011) showed that most of the rice cultivation in Cambodia relies

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heavily on rainfall than the irrigation system and lacks proper technology, which limits productivity. Furthermore, supplemental irrigation for both seasons is essential for food security.

Table 1: Summary Statistics the Inputs of the Rice Production per hectare

Variable	Units	Obs	Mean	Std. Dev.	Min	Max
Rice outputs	Kg/ha	240	4,977	3,996	2,080	6,374
Seed	Kg/ha	240	234	117	250	420
Pesticides	ml/ha	240	4,472	3,934	-	6,500
Weedicides	ml/ha	240	2,165	1,922	-	2,400
Fertilizer	Kg/ha	240	269	206	100	500
Irrigation	dummy	240	0.64	0.48	0	1
Household labor	person/ha	240	8	2	2	13
Hired labor	person/ha	240	8	5	-	17
Transportation	ton/ha	240	5	1	2	13
Age_HHhead	year	240	49	12	22	88
Education_HHhead	level (0-5)	240	2	1	0	5
Family size	person	240	5	1	2	9
Income off-farm	KHR/ha	240	2,886	2,897	-	4,000

Note: education; 0=illiterate, 1=literate, 2=primary, 3=secondary, 4=high school, 5=university

The average household labor was about 8 persons per hectare in both seasons, whiles the maximum and minimum are around 13 and 2 persons, respectively. From 2005 to 2013, the number of working days decline to 34% for wet season rice and 52% for dry season rice but increased working days for vegetables. Therefore, mixed crops, rainy season and dry season rice need to have more workdays than other crops. In addition, the average hired labor is about the same as that of household labor, but the maximum of hired labor is higher compared to household labor. The average transportation was around 5 tons/per hectare and, the maximum and minimum are about 13 tons and 2 tons for dry season rice, respectively.

Furthermore, the summary statistics reveal that the average age of the household's head was 49 years old and ranged from 22 to 88 years old. In other words, the results displayed for age are similar to the research of Sokvibol et al.

(2016) in the technical efficiency analysis of Cambodian household's rice production. Moreover, the average education level was 2, implying that most of the farmers' household head obtained education at primary school (grade 1-6 in the Cambodian education system). The result obtained is lower than Sokvibol et al. (2016) research, which showed that most of the farmers' household heads gained an education up to secondary school. The results also displayed that the average family size of peasant households in Takeo, Kampong Speu and Kandal is around 5 persons per household and ranges from 2 to 9 persons per household. The average income from the off-farm job approximated to 2886 thousand riels, and the maximum was 4,000 thousand riels of rice in the dry season.

The Estimated Parameters of Rice Paddy in the Wet Season

Table 2 demonstrates that all variable's estimated parameters are in conformity with the expectation. The fertilizer had a positives coefficient that is significant at a 1% level, while herbicides, family size, and income off-farm jobs had positives parameters are significant at 5% level and seed, hired labor, and age of household head are significant at 10% level. Furthermore, the current study also illustrated the input of pesticides did not impact the output in the wet season. Likewise, the education of the household head has a negative coefficient and also verified that it is not influencing rice production during the study.

The Cobb-Douglas production function has applied to estimate parameters of inputs affected the production in the wet season. The results illustrated that seed, fertilizer, herbicides, hired household labor; the age of household head and income off-farm job could cause the increase of household farming rice output. If there is a 1% increase in the input of seed would increase the rice yield of the wet season by roughly 0.0720%. Other research on the analysis of rice production and contribution economic growth by Nhat and Roengchai (2015) found that the Cambodian rice increase by 1.35% while the seed increase at a 1% level. A 1% increase in the input of weedicides will increase rice production by an amount of 0.0434%. The rice output will increase by approximately 0.2587% if a 1% increases in the input of fertilizer. In this case, Sokvibol et al. (2016) researched

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on technical efficiency analysis of Cambodian household's rice production found that a 1% increase of fertilizer would increase of household rice output by 5.6%. Similarly, Yu and Fan (2009) demonstrated that fertilizer in the wet season paddy was significant to impact the production, with a .024% and they also modified that the percentage of household farming using fertilizers increased for both seasons of rice production. On average, about 78 % of rice in the wet season plots used fertilizers, and the percentage increased to 88 % in 2007. 1% of the input of hired labor will increase the rice output by about 0.1114 %. Conversely, Sokvibol et al. (2016) presented that labor input in the wet season was not significant with household rice output. But Yu and Fan (2009) found that labor input was significant with rice production and they depicted in 1% increase labor input would elevate production by 0.04%. An increasing of 1% of the age of the household head will decrease rice production by roughly 0.0797 %. Similarly, Rido (2014) studied factors affecting the cost efficiency of Cambodian rice farming households, demonstrated that the age of household head had a negative but significant with the rice production. Thus, the age of farmers can be a proxy of farming experience. A 1% increase in the household size would elevate the wet paddy production by amount 0.0485%. The rice output will increase by approximately 0.0469% if a1% increases in income off-farm job.

In addition, most Cambodian farmers can cultivate rice only once a year due to a lack of irrigation and good water management practices. Rice is predominantly grown in the rainy season, producing 80 percent of the total crop; irrigation facilities are mainly used for the dry season rice and complete the wet season paddy if needed (Smith and Hombuckle 2013). Yu and Diao (2011) reasoned that Cambodia has an enormous potential to increase rice production since it is known for its plentiful agricultural land and water resource. If the rice fields are irrigated, the production will increase.

In short, fertilizer use has a greater impact on paddy rice production, followed by herbicides, household size, non-farm income, seed, hired labor force and household age, while farmers use higher volumes are significant the rice production in the wet season.

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Table 2: Estimated Parameters of the Cobb-Douglas for rice in the wet season

Variable	Coefficient		Standard Error	t-ratio	P>t
Constants	β_0	6.5708	0.5095	12.9000	0.000***
lnseed	β_1	0.0720	0.0394	1.8300	0.074*
lnpesticides	β_2	-0.0281	0.0585	-0.4800	0.633
lnherbicides	β_3	0.0434	0.0845	4.5100	0.031**
lnfertilizer	β_4	0.2587	0.0865	8.6800	0.002***
lnhousehold_labor	β_5	-0.0503	0.0778	-0.6500	0.521
lnhired_labor	β_6	0.1114	0.0724	1.5400	0.053*
lnage_household_head	β_7	-0.0797	0.0677	-1.1800	0.065*
lnfamily_size	β_8	0.0485	0.0601	2.8100	0.024**
lneducation	β_9	-0.0248	0.0436	-0.5700	0.571
lnincome_off	β_{10}	0.0469	0.0196	4.3600	0.024**
Prob > F	= 0.0355				
R-squared	= 0.3284				
Adj R-squared	= 0.1745				
Root MSE	= 0.1386				

Note: ***, ** &* indicate significant at 1%, 5% and 10% respectively.

The Estimation Parameters of rice in the dry season

The empirical results of Cambodian rice production in the dry season are shown in table 3. All variables appeared with both the positives and negatives sing. Surely, seed, fertilizer, pesticides, irrigation, household labor, hired labor, transportation, age of household head; household size and income off-farm are the main significant affecting the rice production in the dry season. The Cobb-Douglas production function model was employed to explore the inputs that are influential to the rice output in the dry season. Therefore, the results of the household farming in rural southern Cambodia reveals that, if there is a 1% increase in the input of seed it will consequently increase the total output of the dry season rice by approximately 0.696% and if 1% increases in the input of

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fertilizer would increase the rice output of about 0.175%. A 1% increase in the input of pesticides will increase the total outputs by approximately 0.513%. Rice yield would increase by 0.081% if irrigation systems enlarge by 0.014 %. The total rice output will increase by around 0.094% if a 1% increase in the input of household labor. An increase of 1% in the input of hired labor will increase the rice output by about 0.044%. A 1% increase in the input of transportation will increase the rice output in the dry season by 0.767%. A 1% increase in the input of the age of household head will decrease the rice output by about 0.0569%. An increase of 1% in the families' size will increase the rice output by an amount of 0.217%. A1% increase in the input of income from an off-farm job will increase the rice output by roughly 0.418%. Other research on rice production response in Cambodia by Yu and Fan (2009) exposed that fertilizer is important to the rice production in dry season paddy while a 1% increase of fertilizer would impact to elevate the rice yield by about 0.25%, while the irrigation system is also major significant the production. Other than, varieties in dry season paddy was needed more requirement of fertilizer, pesticides, irrigation facilities and so on. The requirement of agricultural inputs was needed higher than the wet season paddy. In order to elevate their agricultural production, most farmers used their capital to buy inputs including fertilizer, pesticides, and others (Pisidh et al.2011).

Comparatives the estimated parameters of wet and dry season paddy, parameters of fertilizer are the main important and the biggest contributor to increment of rice production in the wet season while transportation and seed are the core significant influential the rice production in the dry season. In the wet season, hired labor and seed are the second, third largest of coefficients. Similarly, income off-farm and pesticides are the second and third coefficients in the dry season. Thus, the variation of seed, fertilizer, pesticide, household labor, hired labor, irrigation facilities, transportation, age of head household, family size and income off-farm jobs are affected by the rice production of dry season paddy.

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Table 3: Estimated Parameters of the Cobb-Douglas production for dry season

Variable	Coefficient		Std. Err.	t	P>t
Constants	β_0	6.8814	0.2070	33.25	0.0000***
lnseed	β_1	0.6961	0.0237	8.52	0.0001***
lnfertilizer	β_2	0.1752	0.0208	3.73	0.0303**
lnpest	β_3	0.5136	0.0197	4.69	0.0010***
lnherb	β_4	-0.0158	0.0203	-0.78	0.4370
dummyirri	β_5	0.0812	0.0325	2.50	0.014**
lnhomlabor	β_6	0.0940	0.0385	1.14	0.0460**
lnhired	β_7	0.0447	0.0239	1.87	0.0640*
lntran	β_8	0.7674	0.0416	18.45	0.0000***
lnage	β_9	-0.0569	0.0365	3.46	0.0450**
lnfamily	β_{10}	0.2174	0.0290	3.68	0.0205**
lnedu	β_{11}	-0.0095	0.0188	-0.5	0.6150
lnincome	β_{12}	0.4188	0.0113	1.65	0.0020***
Prob>F	=	0.0000			
R-squared	=	0.8645			
Adj R-squared	=	0.8478			
Root MSE	=	0.0819			

Note: ***, ** &* indicate significant at 1%, 5% and 10% respectively.
Source: Author

CONCLUSIONS

The study carried out the Cobb-Douglas function to estimate rice production for Cambodian rice by using 2018 household surveys. The findings illustrate that seed, fertilizer, hire labor and income off-farm is a major determinant of paddy in both seasons. Based on the study of rice production in rural south-eastern regions in Cambodia, we would like to conclusions and suggestions as follows:

Firstly, most farmers did not use properly varieties with plot size and other farmers used their previously seeds in the next season of farming. A 1% increase in varieties use could increase wet season paddy by 0.072% and 0.69% in the dry

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season. Thus, farmers can increase their rice output, if they selected appropriate seed. Secondly, fertilizer has found a significant impact on production. A 1% in fertilizer use would elevate the rice output in the wet season by 0.25% and dry season by 0.17%. The majority of farmers cannot apply a suitable quantity of fertilizer due to its increment cost. The concerns of the chemical fertilizers include licenses that seek to rent and promote illegal imports and restrictions to imports by MAFF. The following standard products were imported due to market principles and forced import from neighboring countries. On the other hand, limited border control and monitoring allow the importation of low-standard products. Hence, the government and stakeholders should train farmers on how to apply suitable among fertilizer and appropriated rice growth stages. In addition, the government should improve to restrict illegal imports and low-standard fertilizers and should set up local factories to produce natural fertilizers and chemical fertilizers rather than import from neighboring countries.

Thirdly, rural infrastructure especially the availability of roads has been one of the main issues faced in the country for decades. The poor road makes transportation of inputs and output difficult and also high transportation costs. Crucial roads linking to markets, production and industrial sites should be considered. Another choice, railway transportation has been one of the cheapest means of conveying both goods and passengers in the developed countries. Thus, the government should carry on railway project and appropriated railway lines to connect main production sites and industrial zones. Fourthly, the age of household head is the important influence the production. Due to many cultivators still, practice traditional growing. Thus, this is not a satisfactory situation as it is well-known that the traditional way of cultivation doesn’t produce a high yield. Some countries have converted their agricultural sector from being traditional to modern or smart agriculture and transmuted their farmers from being subsistent to commercialize thus we also should transform the Cambodian agricultural sector. The government ought to distribute the knowledge of modern agriculture and inspire cultivators to adopt the knowledge trough training and workshop.

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