**American Journal of Agriculture and Forestry**
2021; 9(6): 424-430
http://www.sciencepublishinggroup.com/j/ajaf
doi: 10.11648/j.ajaf.20210906.21
ISSN: 2330-8583 (Print); ISSN: 2330-8591 (Online)

# An Assessment of Input Cost At Different Stages of Rice Growth and Its Effect on Production Cost on Cobb-Douglas Function in Cambodia

**Sar Sary[1, 3, *], Bun Phearin[1], Sarin Sereyvatha[1], Sar Saren[2], Srey Sophyn[1], Muyobozi Sikalubya[3, 4]**

[1]Research and Development Technology Canter, National Polytechnic Institute, Ministry of Labour and Vocational Training, Phnom Penh, Cambodia

[2]Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, Cambodia

[3]Chinese Academy of Agricultural Science, Beijing, China

[4]School of Humanities and Social Sciences, University of Zambia, Lusaka, Republic of Zambia

**Email address:**
sarsary@npic.edu.kh (S. Sary), bphearin@npic.edu.kh (B. Phearin), sereivatha@npic.edu.kh (S. Sereyvatha), sarsaren168168@gmail.com (S. Saren), sophy@npic.edu.kh (S. Sophyn), muyobozi2016@isscard.pku.edu.cn (M. Sikalubya)

[*]Corresponding author

**To cite this article:**
Sar Sary, Bun Phearin, Sarin Sereyvatha, Sar Saren, Srey Sophyn, Muyobozi Sikalubya. An Assessment of Input Cost At Different Stages of Rice Growth and Its Effect on Production Cost on Cobb-Douglas Function in Cambodia. *American Journal of Agriculture and Forestry.* Vol. 9, No. 6, 2021, pp. 424-430. doi: 10.11648/j.ajaf.20210906.21

**Received**: December 7 2021; **Accepted**: December 21 2021; **Published**: December 31, 2021

**Abstract:** The data analyzed in this study was obtained through a household survey from the three provinces in Cambodia. The sampling was done through which 540 farmer households were randomly selected. It applied Cobb-Douglas cost to examine the effect of input cost in different stages of rice growth on the total production cost. The result reveals that dry paddy, a 1% increase in the cost of the seedling stage would increase the rice production cost by approximately 25%. A 1% increase in input cost of jointing and booting stages would increase rice cost to 15%. And a 1% increase in farm size would increase output cost by roughly 17%. It means that the percentage change of the input cost of dry paddy would change output cost by 1%. In wet paddy, a 1% increase in input cost of the tillering stage would increase the rice cost by 28%. A 1% input cost of popular and milk stages would affect the output cost to approximately around 24%. A 1% increase in income off-farm jobs would increase rice costs by 11%. The elements of cost inputs of rice growth stages include fertilizer, pesticides, herbicides, irrigation, hired labor; land preparation and transportation stand out as the most crucial factors to contribute to the increment of cost output in wet paddy. These findings have a significant impact on how to boost rice production in Cambodia. Farmers are likely to benefit the most from improved agricultural productivity and technology. The study emphasizes that Cambodian farmers need to focus on agriculture to achieve increased rice production and poverty reduction in rural areas. As most of Cambodia includes poor people who live in rural areas and depend on agriculture, high agricultural growth will provide food security by increasing supply, reducing prices, and increasing households' income.

**Keywords:** Cost Production Function, Rice Production Cost, Cambodia

## 1. Introduction

Cambodia is located in South-East Asia and has a tropical monsoon climate of two seasons, dry season, and wet season [3]. Agriculture is the top priority for the national development agenda. The poverty reduction through improving food security, household income, and employment-based on agricultural development was expected by the royal government. Economic growth and macroeconomic stability were contributed by agricultural development [15]. The leading agrarian activities are rice, subsidiary and industrialized crops, livestock, and poultry. The ecosystems for growing rice are four in Cambodia including dry season paddy, floating paddy, rainfed lowland rice, and rainfed upland rice [3]. Climate change affects rice production and other crops in the wet season. Moreover, a short drought happens in late July and early August during the wet season.

In Cambodia, rice is a staple food, the leading crop, and a valuable source of income for 85% 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 [6]. Income from crops has increased annually because of yield increase, thus, the cost of production is 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 unaffordable prices 24% and rice production 23% [22].

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 agricultural 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 [2]. Furthermore, the key inputs of rice production are seeds, fertilizers, pesticides, insecticides, farmland, and hired labor, and some may 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 [6].

In the current year, although the studies of cost production in difference stages of rice growth is rare, but there are some research agencies such as Cambodia Development Resource Institute (CDRI) and Cambodian Agricultural Research and Development Institute (CARDI) are working on rice policies and rice productivities [21]. Thus, this study attempts to contribute to rice production literature of Cambodian agriculture by assessment of inputs cost at varies stage among rice production in the South-East region (specifically Takeo, Kandal and Kampong Speu provinces) which are the high potential regions of rice production.

## 2. Data Description

### 2.1. Data Collection

The data analyzed in this study was obtained through a household survey conducted in 2020 from the three stated provinces in Cambodia. Random sampling was done through which 540 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 covered several aspects of the rural farmers encompassing Household conditions such as 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 rice inputs of dry season rice included seeds, pesticides, herbicides, fertilizer, irrigation, household labor, hired labor, transportation, and others. An increase in inputs affected the production of rice in the wet season and in 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 to minimize sample bias options. Data modification and filtering were performed to ensure that the unit of measurement for each variable is consistent with the academic goals and the quality of the data is satisfactory.


| Nº | GIS Code | District Name | Number Of Commune | Number Of Village | Studied Villages |
|---|---|---|---|---|---|
| 1 | 201 | Basedth | 8 | 76 | 3 |
| 2 | 202 | Kong Pisei | 10 | 70 | 3 |
| 5 | 205 | S'ang | 7 | 45 | 3 |
| 6 | 206 | Kaoh Thum | 9 | 92 | 3 |
| 7 | 207 | Prey Kabbas | 5 | 38 | 2 |
| 8 | 208 | Bourey Cholsar | 10 | 64 | 4 |


***Figure 1.*** *Map of Cambodia and Sample Site.*

### 2.2. Constraints of Rice Production Cost

To assess the rice production constraints in this study we categorized three species which include biotic, abiotic, and socioeconomic constraints. The biotic constraints are related to all living factors including plants, animals, and humans, while the abiotic constraints are associated with non-living factors such as weather, temperature, geography, wind, rain, or natural disasters. Likewise, socioeconomic constraints deal with social issues and economic factors [1]. Data analysis was classified into four rankings (from 0 to 4) each of the classification constraints is relevant to the level of occurrence to influence the rice production. Zero (0) ranking presents that the respondents didn't know the constraints, while one (1) ranking appoints that it is the constraints none existing or not significant to affect the rice production. Furthermore, two (2), three (3), and four (4) ranking are modified about the low, medium, and high constraint, respectively.

### *2.2.1. Biotic Constraints*

The biotic constraint factor in figure 2 illustrates the average ranking divided into 4 ranks (1=non-existing, 2=low, 3=medium, and 4=high) and separate three categories namely: weed, disease/insects, and rodents in rural Cambodian. Weed is a major constraint factor to influence rice production with an average ranking, while disease or insects have an average ranking above 3; it means that disease or insects are the medium constraints factor to the rice production. On the other hand, the average ranking of rodents is around 2, which changes that rodents are low constraints factors. As mentioned, the constraint factors are most affected by the rice production of Cambodian farmers, if farmers prevent the constraints they could increase the rice yield.

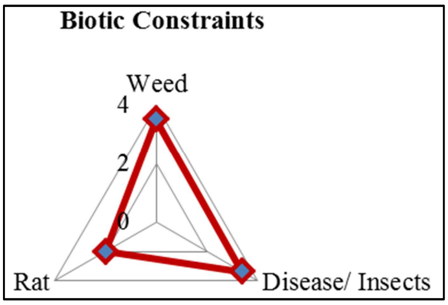


***Figure 2.*** *Average Ranking of Biotic Constraints.*

### *2.2.2. Abiotic Constraints*

The abiotic constraint factor in figure 3 is related to weather conditions or a natural phenomenon. In the study area, the interviewed farmers were affected by abiotic constraints according to the occurrences rate and damage of drought, flood, soil erosion, wintry weather, soil quality, and heat stress. The average opinion of the farmer to rice production constraints affected by abiotic constraints includes heat stress, poor soil quality, and drought (on average rank about 3), while low constraint factors include flooding, soil erosion, and cold temperature.

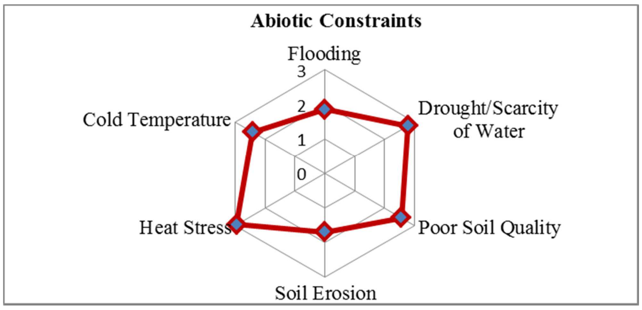


***Figure 3.*** *Average Ranking of Abiotic Constraints.*

### *2.2.3. Socioeconomic Constraints*

The socioeconomic constraints are related to the excessive cost and unattainability or difficulties to access critical factors to rice production including credit cost, seed cost, land cost, labor cost, fertilizer cost, agrochemical cost, mechanization, market, transportation, road facilities, technology, and irrigation infrastructure. Figure 4 depicted an average ranking of socioeconomic constraints. The market and agrochemical cost constraints are high-ranking constraints to rice production. During the conducted field research, most of the farmers complained about the low market price and price volatility due to intermediary findings their low price and lack of government or stakeholder interventions worsened these challenges. In addition, the inflated cost of agrochemicals is of major concern to farmers as they overspend to meet the high cost of agrochemical to prevent crop diseases prevent diseases, or insects and increase their output. Other factors (credit cost, seed cost, labor cost, fertilizer cost, mechanization cost, transportation cost, road facilities, technology, and irrigation infrastructure) are medium constraint factors to the farmers' feeling of the production. Besides, socioeconomic factors also show the confronting of farmers who didn't increase output or productivity.

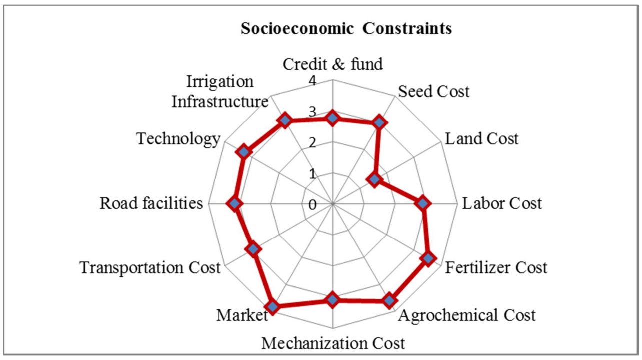


***Figure 4.*** *Average Ranking of Socioeconomic Constraints.*

## 3. Research Methodology

The study applied the Cobb-Douglas cost production function, using STATA software to analyze cost input in different growth stage rice and its effect on the production cost of rice. This study is a buildup on new production function with technological innovation using cobb-douglas production function applied 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 how input quality drive measured difference in 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 studied 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-Douglas production function model on some selected manufacturing industries in Oman by Hossain et al 2010. Therefore, the study will contribute to increasing the rice production cost in rural Cambodia to surge household income and reduce poverty reduction.

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

$$C = AK^{\beta 1}L^{\beta 2} \tag{1}$$

Where:

C = the total Cost production of a 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 coefficients to be estimated of labor and capital, respectively

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

$$\ln C = \ln A + \beta_1 \ln K + \beta_2 \ln L \tag{2}$$

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

$$\ln C = \beta_0 + \beta_1 \ln K + \beta_2 \ln L + \ldots + \beta_i \ln K \tag{3}$$

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

Cobb-Douglas Cost Production functions for dry and wet paddy as bellow:

$$\ln C_{dry} = \beta_0 + \beta_1 \text{lncost\_seedling\_dry} + \beta_2 \text{lncost\_tillering\_dry} + \beta_3 \text{lncost\_joint\_dry} + \beta_4 \text{lncost\_pop\_dry} + \beta_5 \text{lncost\_rip\_dry} + \beta_6 \text{lnagri\_extendummy\_dry} + \beta_7 \text{lnfarm\_size} + \beta_8 \text{lnage\_HHhead} + \beta_9 \text{lnfamilysize} + \beta_{10} \text{lnedu} + \beta_{11} \text{lnincome} + \varepsilon_{i\_dry} \tag{4}$$

$$\ln C_{wet} = \beta_0 + \beta_1 \text{lncost\_seedling\_wet} + \beta_2 \text{lncost\_tillering\_wet} + \beta_3 \text{lncost\_joint\_wet} + \beta_4 \text{lncost\_pop\_wet} + \beta_5 \text{lncost\_rip\_wet} + \beta_6 \text{lnagri\_extendummy\_wet} + \beta_7 \text{lnfarm\_size} + \beta_8 \text{lnage\_HHhead} + \beta_9 \text{lnfamilysize} + \beta_{10} \text{lnedu} + \beta_{11} \text{lnincome} + \varepsilon_{i\_wet} \tag{5}$$

Where,

$\ln C_{dry}$: logarithm of yield cost per hectare in dry paddy

$\ln C_{wet}$: logarithm of yield cost per hectare in wet paddy

lncost_seedling: logarithm of seedling stage cost

lncost_tillering: logarithm of tillering stage cost

lncost_joint: logarithm of jointing and booting stage cost

lncost_pop: logarithm of poplar, milk and dough stage cost

lncost_ripe: logarithm of ripe stage cost

lnagri_extendummy: logarithm of agricultural extension dummy

lnfarm_size: logarithm of farm size

lnage_HHhead: logarithm of age household head

lnfamilysize: logarithm of family size

lnedu: logarithm of education of household head

lnincome: logarithm of household income

$\varepsilon_{i:}$ error terms

The coefficient $\beta_1$, $\beta_2$, $\beta_3$ … $\beta_i$ are the elasticity yield for input L, K and X. The sum of elasticity

$\beta_1 + \beta_2 + \beta_3 + ... + \beta i$, supplies the returns to scale of the farms in question. It means if:

$\beta_1 + \beta_2 + \beta_3 + \ldots + \beta_i, = 1$, the production runs under constants returns to scale.

$\beta_1 + \beta_2 + \beta_3 + \ldots + \beta_i, > 1$, the production runs under increasing returns to scale.

$\beta_1 + \beta_2 + \beta_3 + \ldots + \beta_i, < 1$, the production runs under decreasing returns to scale.

# 4. Results and Discussion

Cambodian farmers usually applied different costs of inputs at various stages of rice cultivation. The inputs cost of the dry season rice is included seed, fertilizer, pesticides, herbicides, land preparation, hired labor, irrigation system, transportation, harvesting, and others. The Cobb-Douglas cost production function was carried out to estimate the parameter in this study. Table 1 presents the estimated parameter of the cost of the inputs of the dry season paddy. The coefficient of the cost seedling stage, jointing-booting stages, and plot size are significant to change cost output in the south-eastern in Cambodia. The cost of the tillering stage, poplar stage, milk stage, ripening stage, and other factors are not more effective with the production cost of dry season paddy. The influence on the cost of inputs during the seedling stage in the production cost is highly significant at 1% with a coefficient of 0.25. On the other hand, a 1%increase in the cost of seedling stage applications would increase the output cost by approximately 25%. The cost of jointing-booting stages presents a positive impact on the cost of rice yield and is significant at a 1% level with an estimated parameter of 0.15, while a 1% increase in the cost of the inputs at jointing-booting stages would increase the production cost by around 15%. Besides, plot size enlargement supplies an extreme impact on the production cost of the dry season paddy, while farm size is significant at a 1% level and the coefficient is roughly 0.17. In the past, Cambodia enjoyed agricultural land abundant, thus, increasing cultivated land might be a short-term solution in attaining food security. But in the long-term improvement in productivity is one possible method for maintaining stable growth [26].

As shown above, the Cobb-Douglas cost production function inspects the cost of inputs in various stages of the rice growth, which means that the percentage change of the production cost if all cost factors are increased by 1%. Furthermore, the cost of seed, fertilizer, pesticides, herbicides, land preparation, hired labor, irrigation, and transportation are highly significant for the seedling stage, jointing, and booting stages, respectively, while the plot size is also extremely significant in all stages of rice growth.

***Table 1.*** *Estimated Parameters of the Cost Production for Dry Paddy.*

| Variable | Coef. | | Std. Err. | t | P>t |
|---|---|---|---|---|---|
| Constant | $\beta_0$ | 9.045 | 1.311 | 6.900 | 0.000*** |
| lncost_seedling_dry | $\beta_1$ | 0.256 | 0.069 | 3.730 | 0.000*** |
| lncost_tillering_dry | $\beta_2$ | 0.022 | 0.084 | 0.260 | 0.792 |
| lncost_joint_dry | $\beta_3$ | 0.155 | 0.050 | 3.110 | 0.003*** |
| lncost_pop_dry | $\beta_4$ | 0.039 | 0.047 | 0.820 | 0.412 |
| lncost_rip_dry | $\beta_5$ | 0.128 | 0.080 | 1.600 | 0.113 |
| lnagri_extension_dummy | $\beta_6$ | -0.006 | 0.044 | -0.130 | 0.897 |
| lnfarm_size | $\beta_7$ | 0.177 | 0.054 | 3.280 | 0.002*** |
| lnage_HHhead | $\beta_8$ | 0.013 | 0.085 | 0.150 | 0.879 |
| lnfamily_size | $\beta_9$ | -0.053 | 0.076 | -0.700 | 0.486 |
| lnedu | $\beta_{10}$ | -0.008 | 0.044 | -0.180 | 0.858 |
| lnincome | $\beta_{11}$ | -0.001 | 0.023 | -0.050 | 0.960 |
| F(11, 86) | = 5.08 | | | | |
| Prob > F | = 0 | | | | |
| R-squared | = 0.3939 | | | | |
| Adj R-squared | = 0.3164 | | | | |
| Root MSE | = 0.17878 | | | | |

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

Rice production in Cambodia is separated into two categories: the wet season paddy and the dry season paddy, and within the wet season rice production, there are five species of rice, namely, early, medium, late, upland, and floating rice. Likewise, the growth stage of the wet rice is not different from the growth stage of the dry rice but the period of the wet rice is normally longer than the dry rice. Thus, we employed the Cobb-Douglas cost production function to estimate the cost of inputs in various stages of rice growth. Table 2 is depicted in the coefficient of the wet rice. The cost inputs of the tillering, poplar, milk, and drought stages involved in the production cost were positively affected by the output and it was highly significant at a 1% level for the tillering stage, while the poplar, mike, and dough stages were significant with 5% level. Moreover, the income off the job is also highly significant at the 1% level. In other words, a 1% increase in the cost of the tillering stage would increase the production cost by around 28%, while a 1% increase in the cost of poplar, milk, and dough, respectively would increase the output cost by roughly 24%. On the other hand, if a 1% increase in income off the job would increase by about 11%. The elements of cost inputs of rice growth stages include fertilizer, pesticides, herbicides, irrigation, hired labor; land preparation and transportation stand out as the most crucial factors to contribute to the increment of cost output.

As mentioned above, the research carried out a Cobb-Douglas cost production function to examine the variation between the cost of inputs and the cost of outputs during the wet season paddy. If the percentage change of the cost output if all factors of cost inputs are increased by one percent.

***Table 2.*** *Estimated Parameters of Cost Production for the Wet Paddy.*

| Variable | Coef. | | Std. Err. | t | P>t |
|---|---|---|---|---|---|
| Constant | $\beta_0$ | 7.243 | 2.058 | 3.520 | 0.001*** |
| lncost_seedling_wet | $\beta_1$ | -0.088 | 0.055 | -1.600 | 0.112 |
| lncost_tillering_wet | $\beta_2$ | 0.284 | 0.094 | 3.020 | 0.003*** |
| lncost_joint_wet | $\beta_3$ | -0.037 | 0.080 | -0.460 | 0.644 |
| lncost_pop_wet | $\beta_4$ | 0.244 | 0.119 | 2.050 | 0.043** |
| lncost_rip_wet | $\beta_5$ | -0.034 | 0.109 | -0.310 | 0.757 |
| lnagri_extension_dummy | $\beta_6$ | 0.054 | 0.054 | 0.990 | 0.323 |
| lnfarm_size | $\beta_7$ | -0.027 | 0.077 | -0.350 | 0.730 |
| lnage_HHhead | $\beta_8$ | 0.093 | 0.102 | 0.910 | 0.366 |
| lnfamily_size | $\beta_9$ | 0.115 | 0.077 | 1.490 | 0.139 |
| lnedu | $\beta_{10}$ | 0.005 | 0.055 | 0.100 | 0.924 |
| lnincome | $\beta_{11}$ | 0.114 | 0.033 | 3.450 | 0.001*** |
| F(10, 101) | = | 2.88 | | | |
| Prob > F | = | 0.0033 | | | |
| R-squared | = | 0.2222 | | | |
| Adj R-squared | = | 0.1452 | | | |
| Root MSE | = | 0.2721 | | | |

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

# 5. Conclusion

This study carries out the Cobb-Douglass Cost Production Function to inspect the cost of inputs at different stages of rice growth in rural farming Cambodia. It proves that the coefficient of some factors of wet and dry paddy was significant with rice cost. Rice production in Cambodia was influenced by three constraints including biotic constraints, abiotic constraints, and socio-economic constraints. The biotic constraint was separated into three factors namely: weed/ disease, insects, and rodents. Weed is a major constraint to influence the rice production cost, while disease or insects is secondly affected, and rat is thirdly influencing rice production. The abiotic constraint factors change the weather and ecological condition to effects crop growth. It is related to flooding, drought/scarcity of water, cold temperature, heat stress, and poor soil quality. Socio-economic constraints are related to the prohibitive cost and unattainability or difficulties to access critical factors to rice production such as credit cost, seed cost, land cost, labor cost, fertilizer cost, agrochemical cost, mechanization, market, transportation, road facilities, technology, and irrigation infrastructure.

Based on the results for dry paddy, a 1% increase in the cost of the seedling stage would increase the rice production cost by around 25%. A 1% increase in input cost of jointing and booting stages would increase rice cost amount 15 percent. And a 1% increase in farm size would increase output cost by roughly 17%. In wet paddy, a 1 percent increase in input cost of the tillering stage would increase the rice cost by 28%. A 1 percent input cost of popular and milk stages would affect the output cost around 24%. Moreover, a 1 percent increase in income off-farm jobs would increase rice cost by 11 percent.

These findings have an important effect on how to boost rice production in Cambodia. The farmers are likely to benefit most from improvement in agricultural productivity and technology. It is clarified that Cambodian farmers ought to focus on the agriculture sector to achieve rice production growth and poverty alleviation in rural areas. Due to most of Cambodia's poor people living in rural areas and relying on agriculture, high agricultural growth will provide food security through increased supply, reducing prices, and rising incomes of the poorer farm household. To facilitate this response and achieve food security, neglected agriculture has been included in the political agenda. Firstly, there is significant scope for improving rice production in Cambodia. It is possible to increase Cambodian rice output to the level of its neighbor countries if appropriate inputs (fertilizer, irrigation) and infrastructure (electricity markets, agricultural extension, and education) are provided. Given the high awareness of fertilizer, farmers could noticeably increase their yield and revenue from more market sales [27].

Secondly, the promotion of advanced technologies and crop diversification should be organized according to local conditions. Nevertheless, poor road and market conditions prevent local producers from benefiting from the comparative advantage of rice production. Greater investment infrastructure enables farmers to gather the latest market information and ship their produce to Phnom Penh and other regional markets. Rural investment roads have high yields returns on poverty reduction in developing countries [26]. Improving rural roads will enable rural people to access essential services.

# Acknowledgements

This article was supported by the Chines Academy of Agricultural Science (CAAS) and Research and Technology Development Center, founded by the National Polytechnic Institute of Cambodia (NPIC).

# References

[1] Ahmed, A, G., Xu, S., Wen, Y., Wang, Y., (2017). Comparatives study on factors influencing rice yield in Niger State of Nigeria and Hainan of China. International journal of agricultural and food research (IJAFR) Vol. 6 No. 1, pp. 15-25 (2017).

[2] AusAid and World Bank. 2012. Turning Cambodian Rice into White Gold. Washington, DC. https://openknowledge.worldbank.org/bitstream/handle/10986/22533/Cambodia000Ric0rice0into0white0gold.pdf?Sequence=1&isAllowed=y.

[3] Bansok, R., Chhun, C., and Phirun, N., (2011). Agricultural Development and Climate Change: The Case of Cambodia. Cambodia Development Research Institute (CDRI).

[4] Budiono, R., and Adinurani, P. G., (2017). Efficiency analysis of production factors utilization in upland rice farming.

[5] CAVAC (2016). Farmers' Behavior on Using Rice Seed in Cambodia. Phnom Penh: Cambodian Agriculture Value Chain Program (CAVAC).

[6] CDRI (2017). Rice Policy: Implications of Rice Policy Changes in Vietnam for Cambodia's Rice Policy and Rice Producers in South-Eastern Cambodia.

[7] CDRI (2011). Irrigation Water Productivity in Cambodian Rice Systems. 8. CEDAC (2009). Inventory of irrigation schemes and farmer water user committees in Cambodia. Case study: Situation within 13 out of 24 provinces. CEDAC Farmer and Water Program.

[8] Dary P., Sokcheng S., and Pirom K., 2017. Synergies and Trade-offs with Intensification of Rice and Livestock Production in Cambodia. Special Report 16-June, 2017 of CDRI.

[9] Hossain, M., and Majumder, A. K., (2015). On the measurement of efficiency of Cobb-Douglas production function with additive and multiplicative errors. Vol. 3, March 2015, pp 96-104.

[10] Hossain, M. Z., and Amri, K. A., (2010). Use of the Cobb-Douglas production model on some selected manufacturing industries in Oman.

[11] Jermy, T. F., and Smeets, V., (2011). Does input quality drive measure differences in firm productivity? International Economic Review. Vol. 52, No. 4.

[12] Khai, H. V., and Yabe, M., (2011). Technical efficiency of rice production in Vietnam.

[13] Koirala, K. H., Mishra, A. K., and Mohanty, S., (2014). Determinates of rice productivity and technical efficiency in the Philippines. Paper prepared for presentation at the Southern Agricultural Economics Association (SAEA) Annual Meeting, Dallas, TX, and February 1-4, 2014.

[14] Liu, S., Jiao, W., Min, Q., and Yin, J., (2017). The Influences of Production Factors with Profit on Agricultural Heritage Systems: A Case Study of the Rice-Fish System. Sustainability Journal.

[15] MAFF (2015a). Agricultural Sector Strategic Development Plan 2014-2018.

[16] MAFF (2015b). Annual Report for Agriculture Forestry and Fishery 2014- 2015.

[17] Nhat, V., and Tansuchat, R., (2015). Analysis of rice production and contribution to Cambodian economic growth. The empirical econometrics and qualitative economics letters volume 4, number2, (June 2015): pp. 17-30. 19. Pisidh, V., Jean, C. D., Mom, S., and Sonly, Y. (2011). Challenges of dry season rice production under irrigation scheme of Tapeing Thmor water reservoir. International journal of environment and rural development.

[18] Qian, L., Zhibin, W., Jiuping, X., (2010). A new production function with technological innovation factor and its application to the analysis of energy-saving effect in LSD. World Journal of Modeling and Simulation Vol. No. 4, pp. 257-266.

[19] Rido, T. (2014). Factors affecting the cost efficiency of Cambodian rice farming households. Forum of international development studies. ISSN 1341-3732.

[20] Smith, D. and Hornbuckle, J., (20130). A Review of rice productivities in Cambodia and water measurement using direct and indirect methods on a dry season rice crop Technical Report to ACIAR, Canberra, CSIRO Sustainable Agriculture Flagship, Australia.

[21] Sokvibol, K., Li, H., and Linvolak, P., (2016). An analysis of technical efficiency for household rice production in Cambodia: A case study of three districts in Battambang province. Global journal of human-social science: E (economics) 2016, 16, 33-44.

[22] Sothy E., Sokcheng S., Chhun Chhim., Pirom K., (2017). Rice policy study: Implication of Rice policy Changes in Vietnam for Cambodia's Rice policy and Rice Producers in South-Eastern Cambodia.

[23] Theng V., Pirom K., and Dary P, (2014). Development of the Fertiliser Industry in Cambodia: Structure of the Market, Challenges in the Demand and Supply Sides, and the Way Forward.

[24] Tun, Y., and Kang H. J., (2015). An analysis of the factors affecting rice production efficiency in Myanmar. Journal of East Asian Economic Integration Vol. 19. No. 2 (Jun 2015).

[25] World Bank (2015). Cambodian Agriculture in Transition: Opportunities and Risks.

[26] Yu, B., and Fan, S, (2009). Rice Production Response in Cambodia. Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16-22, 2009.

[27] Yu, B. and X. Diao (2010). Cambodia's Agricultural Strategy: Future Development Options for the Rice. 30. World Bank (2015). Cambodian Agriculture in Transition: Opportunities and Risks: World Bank.