



Factors Affecting the Farmers' Adoption of Commercial Rice Production in Savannakhet Province, Laos

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ABSTRACT

This study aimed to investigate: 1) a level of commercial rice production adoption of the farmers, and 2) factors affecting the farmers adoption of commercial rice production. The respondents in this study consisted of 177 rice farmers gained by the computation of Yamane's formula (Yamane, 1973). A set of questionnaires was used for data collection and analyzed using descriptive statistics and multiple linear regression was applied to find the factors affecting the adoption of commercial rice production. The study results showed that the farmers had a high level of the adoption of commercial rice production. Based on its detail, two aspects were found at a highest level: preparation of production area and cultivation. However, the other two aspects were found at a high level: maintenance practice and harvest and post-harvest management. In addition, it also found that annual family income, group membership, agricultural training/educational trip, exposure to media, and knowledge/understanding of rice production had a significant positive relationship with the adoption of commercial rice production at a statistical significance level of 0.01 and 0.05. Moreover, to support commercial rice production, the concerned organization should promote the empowerment of elderly farmers by organize agricultural training or study visit, develop irrigation, adding value to rice production under the food safety system, expansion of commercial planting area, increasing channels for receiving agricultural information; and develop domestic and international rice market. These changes would help achieve the government policy to promote commercial rice production around the country for food security, food safety and poverty reduction.

Keywords: Adoption, Commercial Rice Production, Rice Farmers, Laos.

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Background and Significance of the Research Problem

Rice is the staple food and important affecting to the economic, social, cultural and lifestyle of people in the Laos. The income from rice production accounted for 17.23 percent of gross domestic products (GDP). In addition, agricultural sector can support 86 percent of the labor force. Currently, Laos has an area for rice production are 909,267 hectares, it contributes 80% of the total crop production area in the country. It can produce about 4.12 million tons of paddy rice. Approximate 4.5 tons per hectare (Lao Statistics Bureau, 2020). Rice is also an important export commodity, it can generate revenue in millions of dollars a year, and it is also important crop that provides food security in the country as well (Manivong and Rob, 2020). Savannakhet is the largest of rice producing in Laos with total area of rice cultivation is 243,452 hectares. Approximately 26% of total rice production area in the country, total production 911,325 tons include 20% of total rice production in the country (Silinthone. 2020).

The production of rice is only for domestic consumption, but due to the quality of the seeds, the rice does not meet the standard for export markets. Laos has unique species of rice that could be suitable for export if quality was improved and modern industrial production methods were utilized to increase output (Ministry of Agricultural and Forestry, 2015). At the current year, the quantity of rice exports in Laos to foreign markets still low. The government of Laos has a plan to drive production for exporting more than 400,000 tons by the year 2020 and 1,000,000 tons by the year 2025, which was planned by expanding rice planting areas nationwide by an addition the one million hectares of rice production area, and increasing the general average of rice production potential in Laos to be 5 tons per hectare. As causing the whole country to be able to produce more rice 4,220,000 tons, of which 2,700,000 tons is the domestic consumption of rice and are kept in reserve for safekeeping and food security 400,000 tons. The industrial sector is used for processing about 500,000 - 600,000 tons. Therefore, it will be able to export approximately 400,000 tons (Lao Statistics Bureau, 2020).

The Climate-Friendly Agribusiness Value Chains Sector Project (CFAVC) became effective on December 2018 and closes on September 2026. The proposed project supports the implementation of the government's Agriculture Development Strategy to 2025 (ADS) by boosting the competitiveness of rice value chains in Khammouane, Saravan, and Savannakhet provinces. The project will improve the climate resilience of agricultural infrastructure, and enhance crop productivity, diversification, and commercialization. It will help improve the capacity for storage, processing, quality, and safety testing, and promote the use of biofertilizers and organic farming. It will strengthen the capacity of farmers and agribusinesses for climate-

smart agriculture (CSA), and create an enabling environment for climate-friendly agribusinesses to promote sustainability along the value chain (Ministry of agriculture and forestry, 2022).

At the same time, a small number of rice farmers in Savannakhet province (317 farmers) accounted for 0.228% participated in this project which is very small proportion compare to total of the rice farmers in Savannakhet province (137,222 farmers). The farmers prefer to cultivate only an amount sufficient for household consumption. They are not interested in growing commercial rice even though they are in an irrigated area and encouraged by the government project. This study aimed to investigate the main factors affecting commercial rice production adoption in support of government's agriculture development strategy to 2025 and the contribution to local food security and generating additional income for poverty reduction. The results can serve as a guideline for consideration by the relevant government or key development organization to promote commercial rice production in Savannakhet province and throughout Laos.

Research Objectives

This study aimed to investigate:

1. the farmer's adoption level on commercial rice production
2. factors affecting the farmers' adoption of commercial rice production in Savannakhet

Province, Laos

Scope of Research

This research focused on the adoption of commercial rice production of the farmers in Savannakhet Province, Laos. It's included 4 aspects (preparation of production area, cultivation, maintenance practices, and harvest and post-harvest management). The population included 317 rice farming households from 13 villages in 6 District, Savannakhet province. The sample size of 177 rice farmers was determined using Yamane (1973); samples were selected through the multi-stage sampling method, including purposive sampling techniques. The questionnaire was developed based on the research objectives. Both descriptive and inferential statistics were employed to describe the collected data and analyze factors influencing commercial rice production.

Research Hypothesis

Personal, economic, and social attributes are factors affecting the adoption of commercial rice production of the farmers in Savannakhet province, Laos.

Research Methodology

1. Research location, population and sample, and instrumentation for data collecting

This study was carried out in 13 villages, six districts (Xayboully, Champhone, Songkhone, Xonnaboully, Atsaphangthong; and Xayphouthong) of Savannakhet province, Laos. These are the districts with the highest proportion of rice production in the province. (Figure 1).

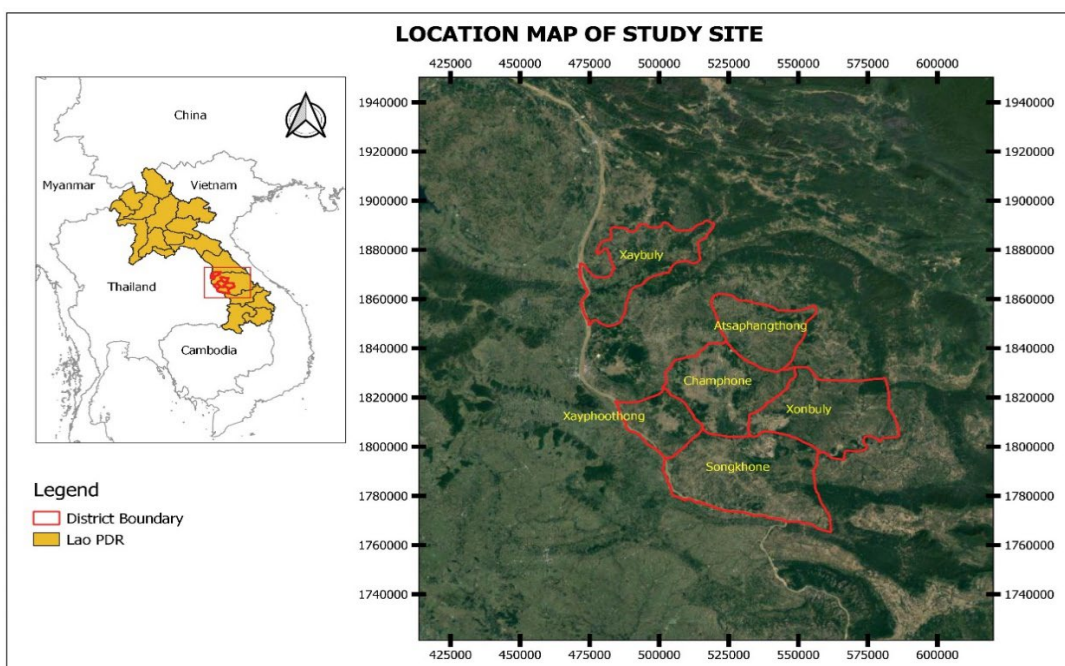


Figure 1 the location map of study sites

Source: Department of Agricultural Land Management (2019)

The population and sample in this study were random by multi-stages:

Stage 1 Calculate the sample size by using Yamane (1973) at a confidence level of 95% and a tolerance of 0.05 to determine the size of the sample from the farmers who participate of the commercial rice production project in 13 villages, 6 districts, Savannakhet province, a total of 317 cases:

$$n = \frac{N}{1 + N(e^2)}$$

Where: n Sample size
 N Total population
 e Random discrepancy at (0.05)

Then will get

$$n = \frac{317}{1 + 317(0.05^2)} = 177 \text{ Samples}$$

Stage 2: Calculate the sample size from the farmers in 13 villages. The total sample was 177 samples, randomly selected from the total number of farmers who participate of the climate-friendly agribusiness value chains sector project in 13 villages, 317 farmers (Table 1). Due to the population in each village is not same. Therefore, it is necessary to find the proportion of the sample size using the formula of Kanlaya (2005)

$$n_i = \frac{nN_i}{N}$$

Where: n Sample size
 N Total population
 N_i Population in each village
 n_i Random sample size in each village

Table 1 The numbers of population and sample in target village

No.	District	Village	No. of Population	Sample Size
1	Xaybouly	Hatxaisoung	27	15
2	Xaybouly	Kangpa-Phonthan	25	14
3	Xaybouly	Buengxe	27	15
4	Champhone	Phalaeng	24	13
5	Champhone	Thouad	25	14
6	Songkhone	Dongsawang	25	14
7	Songkhone	Nongdeune	25	14
8	Xonnabouly	Thakhamleum	25	14
9	Xonnabouly	Kongpathoumvanh	25	14

Table 1 (Continued)

No.	District	Village	No. of Population	Sample Size
10	Xonnabouly	Xienghom	25	14
11	Atsaphangthong	Pongna	11	6
12	Xayphouthong	Mouangkhai	28	16
13	Xayphouthong	Khantachan	25	14
Total			317	177

Source: Ministry of Agriculture and Forestry (2022)

When got the number of samples in each village, was use a simple random sampling method by bringing house numbers to draw lots. so that rice farmers have equal chances to be randomly interviewed.

Data collection was carried out through interview survey, which based on a semi-structured discussion. A first draft of the interview was designed according to the research objectives. Interview schedule was done in the manner of pre-tested during pilot observation organized in the study area. The interview schedule was up-dated based on pilot survey and later on, and used for primary data collection from the farmers who are the rice production. The questions regarding level of the adoption of the commercial rice production, which are 5 levels (adopted from Likert's scale), how much farmer take of the adoption of the commercial rice production (1 = No adoption; 2 = Low adoption; 3 = Moderate adoption; 4 = High adoption; 5 = Highest adoption).

2. Data Analysis

Various descriptive and inferential statistical techniques i.e. percentage, mean, standard deviation, multiple regression analysis was applied for getting meaningful results by using Statistical Packages for the Social Sciences (SPSS).

For analysis of personal, socio-economic attributes of the samples were used descriptive statistics: frequency, mean, maximum, minimum, percentage, and standard deviation.

Adoption quotient of an individual farmer was calculated based on the adoption scores gained by the farmer for the adoption of commercial rice production. A total of 5 stage of adoption were used for calculation of the adoption quotient. On the basis of the adoption quotient, farmers were classified into five categories as following.

Average	Adoption Level
1.00 – 1.80	No adoption
1.81 – 2.60	Low adoption level
2.61 – 3.40	Moderate adoption level
3.41 – 4.20	High adoption level
4.21 – 5.00	Highest adoption level

To find the factors affecting the adoption of commercial rice production in the study area was applied multiple linear regression. A multiple linear regression model measured the relationship between independent and dependent variables. The measured form of the equation was specified as in equation 1:

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{16}x_{16} + \epsilon \quad \dots\dots\dots(1)$$

Y is the dependent variable (Adoption of commercial rice production). X₁, X₂, X₃,...X₁₆ were independent variables (age, marital status, educational attainment, household labor, supplementary occupation, farming size, family income, farming cost, amount of credit, farming experience, contact with agricultural staff, participated in agricultural training/educational trip, exposure to media, contact with neighbors about agricultural production, group membership; and knowledge about commercial rice production). β₀, β₁, β₂...β₁₆ were unknown parameters (constant to be estimated from the data). ε was model error (how much variation there is in our estimate of Y) (Table 2).

Table 2 The designation of symbols and abbreviations of variables used in the study of factors affecting commercial rice production

Variables /Coding	Details	Measurement
Dependent Variable		
Adoption	Adoption of commercial rice production	Average from 4 aspects: <ol style="list-style-type: none"> 1. Preparation of production area 2. Cultivation 3. Maintenance 4. Harvest and post-harvest management

Table 2 (Continued)

Variables /Coding	Details	Measurement
Independent Variables		
AGE	Age	Number (Year)
STA	Marital Status	Married =1, other = 0
EDU	Educational attainment	Primary or lower = 1, other = 0
LAB	Household labor	Number (People)
OCCU	Number of occupations	Number of occupations
LAND	Farming size	Number (Hectare)
INC	Family Income	Number (baht)
COST	Farming costs	Number (baht)
CRE	Amount of credits	Number (baht)
EXP	Farming experience	Number (Year)
CONT	Contact with agricultural staff	Number (Time)
TRAIN	Agricultural training/ educational trip	Number (Time)
MED	Exposure to media	Number (Time)
FRI	Contacts with neighbors on agricultural production	Number (Time)
GRO	Group membership	Number (Group)
KNOW	Knowledge about commercial rice production	Score (0 – 21)

Results

Background of the Respondents

According to results of the study, most of the respondents were male, 51 years old, married and elementary school graduates. They had 4 household workforces, more than one-half of them (67.0%) had supplementary occupation in gardeners, and 1.5 hectares of an agricultural area on average. The respondents had an average annual income of 18,940 baht, they claimed that the farming production cost was 10,541 baht for each time on average. About one-third of the respondents (35%) accessed credit for agricultural production activities. The respondents had 30 years of experience in farming and they contacted agricultural extension staff once on average. They attended agricultural training and joined educational trips once a year on average. The respondents perceived agricultural information through 4 channels. Their exposure to media related to farming was 9 times a year, they contracted neighbor on

agricultural production once a year, and they were members of 4 agricultural groups in their community, and most of the respondents (72.3%) had a moderate level of knowledge about commercial rice production.

Farmers' Adoption of Commercial Rice Production

As a whole, the respondents had a high level of the adoption of commercial rice production ($\bar{X} = 4.15$). based on its detail, two aspects were found at a highest level: preparation of production area ($\bar{X} = 4.68$) and cultivation ($\bar{X} = 4.54$). However, the other two aspects were found at a high level: maintenance practice ($\bar{X} = 3.61$) and harvest and post-harvest management ($\bar{X} = 3.78$) (table 3).

Table 3 The farmer's adoption level on commercial rice production

Adoption of Commercial Rice Production	\bar{X}	S. D	Description
1) Preparation of production area	4.68	0.47	Highest
2) Cultivation	4.54	0.42	Highest
3) Maintenance practices	3.61	0.54	High
4) Harvest and post-harvest management	3.78	0.58	High
Average	4.15	.31	High

Source: Author's Calculation

Factors Affecting the Farmers Adoption of Commercial Rice Production

The analysis of the multiple linear regression shown in table 4 found that family income, group membership, participated on agricultural training or educational trip, exposure to media, and knowledge and understanding of commercial rice production had significant positive relationships with the adoption of commercial rice production at a statistical significance level of 0.01 and 0.05.

At the same time, the other factors that were not significant and were not included in the equation, such as age, marital status, educational attainment, household labor, number of occupations, farming size, farming cost, amount of credit, farming experience, contacts with agricultural staff, contacts with neighbors in agricultural production, may also play a role by combining at a minimal percentage or being an existing factor.

Table 4 Factors affecting the farmers adoption of commercial rice production

Factors	Adoption of Commercial Rice Production		
	Coefficient	t-Statistic	P-Value
(Constant)	2.778**	9.637	0.000
1. Age	0.004	0.964	0.336
2. Marital status	0.041	0.469	0.640
3. Educational attainment	-0.050	-0.429	0.669
4. Household labor	0.001	0.042	0.967
5. Number of occupations	-0.030	-0.843	0.400
6. Farming size	-0.007	-0.294	0.769
7. Family Income	8.338*	2.186	0.046
8. Farming costs	0.005	0.070	0.944
9. Amount of credit	0.003	0.092	0.645
10. Farming experience	-2.194	-0.657	0.512
11. Contact with agricultural staff	0.026	1.447	0.150
12. Agricultural training/educational trip	0.035*	2.998	0.003
13. Exposure to media	0.085*	2.206	0.029
14. Contacts with neighbors in agricultural production	0.033	0.806	0.421
15. Group membership	0.008*	2.842	0.005
16. Knowledge about commercial rice production	0.022*	2.198	0.046
R-squared	0.242 (24.20%)		

Note: * < 0.05 and ** < 0.01.

Source: Author's Calculation

Conclusion and Discussion

As a whole, the respondents had a high level of the adoption of commercial rice production ($\bar{X} = 4.15$). based on its detail, two aspects were found at a highest level: preparation of production area and cultivation. However, the other two aspects were found at a high level: maintenance practice and harvest and post-harvest management. It can be inferred from this study that production of rice in the study area is oriented towards commercialization. Also, family income, group membership, participated on agricultural training or educational trip, exposure to media; and knowledge and understanding of commercial rice production are the significant factors determining the

level of commercial rice production adoption in the study area. Therefore, based on the findings of this study, all tiers of government including the non-governmental organization should endeavour towards training farmers on how to produce on commercial basis. Besides, farmers should be encouraged to expand the farm size under cultivation. In this regard, measures such as land reform that will enhance more access to farm land should be enforced. In addition, agricultural development agencies should provide the farmers with improved agricultural technologies. This should include provision of agricultural information, improved seeds, fertilizers and tractor at subsidized rate. All these measures will improve market-oriented production of rice in Laos and reduce Lao's dependency on rice importation.

According to results of the study, the farmers adopted commercial rice production at high level. This means the farmers know that when they participate in the commercial rice production project, they will earn high yield and high income. Therefore, the government should set a clear policy to increase the capacity to promote the production of good quality rice. and continue to develop the market system to increase competitiveness. The farmers can sell their rice at a satisfactory price and are able to create a stable farming career with honor and dignity. This can improve livelihoods of the farmers. As a result, farmers who do not participate in the commercial rice production project will turn to participate in the project more in the future. This result confirms to a study of Asian development bank (2014) on Improving rice production and commercialization in Cambodia. The findings showed a higher level of commercialization, rice sold, and value of sales can arise from improving irrigation and domestic milling. Likewise, Shamsudeen et al., (2018) conducted a study on adoption of rice cultivation technologies and its effect on technical efficiency in Sagnarigu district of Ghana. Result of the study showed that farmers who adopted the rice cultivation techniques had less technically inefficient than those who did not.

The factors affecting farmer's adoption of commercial rice production comprised five factors i, e, family income, group membership, agricultural training or educational trip, exposure to media; and knowledge/understanding of commercial rice production. Therefore, concerned agencies should take all of these 5 factors into consideration to develop and motivate the farmers an opportunity to grow rice for commercial use in the future.

Family income is also significant and positively related to households' commercialization index. This suggests that farmers who have more household incomes produce more rice than those who do not. Incomes provide farmers with opportunities to be acquainted with input sources and market outlets and also enhances farmers' ability to manage production and

market risks. This is in line with Onyeneke (2017) who found incomes of farmers had a positive and significant effect on the likelihood (adopting improved rice varieties, planting depth, use of agrochemicals, use of fertilizer, mechanized harvesting, improved nursery, and modern rice milling). Meanwhile, Phoukeo et al., (2023) confirmed that incomes had significant relationships with the practice of commercial rice production.

Group membership significantly increases the probability of uptake of planting and fertilizer. Generally, more farmers are involved in farmer organizations' meetings and activities, the more they will access new information about improved rice production and the more she/he will easily develop positive attitude towards the adoption of commercial rice production. This result related with a study of Gideon et al. (2018) which found that group membership such as FBO enhances farmer-to-farmer extension services where knowledge and ideas on farm business and other off-farm activities are transferred from one farmer to the other. Thus, farmers who are members of FBOs are likely to get sufficient awareness and knowledge on farm technologies and, hence, are sensitized to join extension programme for more information on their farm business.

Attending an agricultural training or educational trip was positive and significant on the likelihood of the adoption commercial. rice production. The results also indicate positive and significant ($P \leq 0.05$) relationship between the number of trainings attended and farmers' adoption decision of rice production. That is, training has a positively significant influence on the farmers' adoption of the recommended practices in the study area. Similar findings were remarked by Abubakar (2016) that training participation in agricultural programs including on-farm adaptive research (OFAR) trials, management training plot (MTP) demonstration techniques organized by the national cereals research institute (NCRI) in Nigeria positively and significantly influence farmers' adoption level of lowland rice production technologies.

Exposure to media had a positive effect across commercial rice production indicating that extension contact increases the likelihood of adopting commercial rice production. Extension services serve as an important source of information on agricultural production. Farmers who have significant extension contacts have better chances to be aware of various management practices that they can use to increase rice production. Likewise, Patcha et al, (2017) found that agricultural extension services influenced glutinous rice production, especially for local food security; and also consistent with Awuni et al, (2018) who also found mass media extension mechanisms to positively and significantly influence the adoption of multiple technologies by rice farmers in northern Ghana.

The coefficient of knowledge and understanding was found to be positive and significant ($P \leq 0.05$) in influencing the decision to adopt commercial rice production. The positive influence is expected because more understanding farmers may have good advantage of acquiring better skills and access to innovative information about improved rice production practices. The finding also implies that knowledge and experiences gained over time from working in an uncertainty production environment may help in evaluating the technologies thereby influencing their adoption decision. Similarly, Jukkaphong et al, (2016) found that knowledge and understanding is a factor affecting farmer's readiness and needs for cultivating extension of organic animal feed plants for organic feed factory in upper northern, Thailand. Besides, Waritsara and Kamon (2020) found that knowledge is a factor affecting the planting of Chaiya native rice.

Recommendations

The following were recommended to concerned government agencies, municipality agrarian reform office and others:

1. Since the farmers have adopted the commercial rice production at a high level, concerned government agencies should keep organizing skill enhancement trainings. This helps develop the potential of the farmers in commercial rice production.

2. The improvement of commercial rice production practice and results of this study can help achieve the government policy - shifting from subsistence farming to commercial farming using modern technology and appreciate rice production techniques. This will result in the production of quality and safe rice product for Lao people.

3. Concerned government organization need to increase channels for receiving agricultural information concluded that radio, television, seminars, newspapers, brochures and fliers should be intensively used to disseminate agricultural information among farmers so as to raise productivity in their farms.

4. Related agencies should encourage to form rice production groups in the village. Each group should adopt a practical and concrete model, in terms of regulations, agricultural information dissemination, credit and input support, production techniques, price guarantee, water use management, irrigation management and development, and other practices. This would enable farmers to receive similar information about commercial rice production and employ the same commercial rice production techniques based on group requirements and regulations. The outcome should ensure that the average rice yield among group members does not differ widely.

Further Study

This study was primarily conducted only one province in Laos and the sample respondents are all domestically recruited, therefore the results and findings from this research are more applicable in a rather limited geographical, environmental and cultural context. Further studies can be extended to a larger national scope in order to generalize the research findings. With regards to the research design, the measurements of some of the contributing factors to farmers adoption such as government policies, thus it can be modified in similar study in the future. In addition, Future research can also study on extension pattern development for commercial rice production of the farmers in Savannakhet province and another province.

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