



# Factors influencing commercial rice seed production of Community Rice Centers in Kamphaeng Phet, Thailand

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## Abstract

Community rice centers (CRCs) in Thailand serve a crucial function in producing and distributing good-quality rice seeds to farmers in rural areas. However, not all CRCs can produce rice seeds for commercial sale due to various factors that affect commercial rice seed production. This research was aimed to factors influencing commercial rice seed production of the CRCs. The sample group was 217 members of the CRCs using simple random sampling that were areas for planting rice seeds and good-quality rice. Data were collected through interview forms. Descriptive statistics and binary logistic regression analysis analyzed data. The study results found that the CRCs members who produced commercial rice seeds had an average age of 51 years, an average experience of 10 years in rice seed production, and an average rice seed cultivation area of 37.92 rai per household. The average cost of production was 6,814 baht per rai, with an average yield of 834 kilograms per rai. The average selling price is 9,226 baht per ton. Moreover, factors influencing commercial rice seed production in CRCs include the source of selling rice seed (Selling), management of community rice centers (Management), price of rice seed production (Price), cost of rice seed production (Cost), the yield of rice seed (Production), respectively. The Equation can be written as follows:  $Z = -19.091 + 1.858(\text{Selling}) + 1.241(\text{Management}) + 0.002(\text{Price}) + 0.001(\text{Cost}) - 0.006(\text{Production})$ . This model can predict the chance that the CRCs will produce commercial rice seeds at 72.90 percent, and the forecast is correct at 89.90 percent.

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## Introduction

The increasing demand for rice following the world's population growth has prompted rice-exporting countries to develop their rice production to capture a larger market share. As the world's third-largest rice exporter, Thailand has a market share of 11.9 percent, followed by India and Vietnam, which have a market share of 38.9 percent and 12.9 percent, respectively (Sowcharoensuk, 2022). Therefore, it is necessary to adjust the production process to obtain good quality rice that meets the market's requirements. To produce high-quality rice, good-quality rice seeds must be used with appropriate production technology. However, Thailand faces a problem of a lack of good quality rice seeds (Ministry of Agriculture and Cooperatives, 2019; Srisuantang et al., 2011).

Currently, the situation of rice production and the demand for rice seeds in the 2022/23 crop year, found that Thailand has 66.27 million rai of rice cultivation area. The demand for rice seeds is approximately 1,365,800 tons. However, the rice seed production sources are the Rice Department, Community Rice Center, Agricultural Cooperative and the Association of Collectors and Sellers of Rice Seeds, which can produce only 636,000 tons (The Rice Department, 2023). This results in a shortage of 728,800 tons of good-quality rice seeds. The Rice Department has the policy to support the establishment of community rice centers to produce and distribute good-quality rice seeds to farmers in the community area, and also a good and appropriate source of academic knowledge transfer to farmers in communities across the country. However, only 10 percent of the community rice centers can produce rice seeds that can produce standards of Good Agricultural Practices for Rice Seed (GAP seed) (Ministry of Agriculture and Cooperatives, 2017), can produce rice seeds for sale outside the community, and can produce rice seeds with the private sector as well because community rice center members have had experience in rice seed center seedlings before. However, it was found that most of the management of more than 90 percent of the rice centers still had many problems, including marketing problems, member participation, labor management, management in the form of a group, including the shortage of working capital, and still lack necessary equipment such as rice seed sorting machine, rice seed dryer, warehouse for storing rice seeds, etc. (Makasiri, 2014). Although members of the community rice center have experience in producing good rice seeds, they still need to gain experience in managing the community rice center for commercial rice seed production.

Kamphaeng Phet Province has 35 community rice centers (Bureau of Rice Production Extension, 2021) under the supervision of the Kamphaeng Phet Rice Seed Center, the community rice center with rice seed producers for the Rice Seed Center. They bring the rice-registered seeds from the Kamphaeng Phet Rice Seed Center to produce rice-certified seeds under the Good Agricultural Practices Standards for Rice Seeds (Good Agricultural Practices for Rice Seed: GAP seed). It is a group that was awarded the National Institute of Agricultural Excellence Branch of the rice seed producers for the year 2022 (Ministry of Agriculture and Cooperatives, 2022). It is considered that Kamphaeng Phet Province's group of rice seed producers is a community rice center that has great potential in producing rice seeds that can be used etc., and bring to the management model of the Community Rice Center for commercial rice seed production.

Therefore, this research aimed to study the factors influencing the commercial rice seed production of community rice centers by analyzing the factors that affect the production of commercial rice seeds. The approach derived from this study can be applied to promote the potential of rice seed production in community rice centers, leading to the self-sustainable management of these centers for commercial rice seed production.

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## Literature Review

In this research, the researcher studied and reviewed the literature on the concept Related theory to be integrated following research as follows:

### *Commercial Rice seed Production*

Rice seeds can increase the yield and quality of rice. The production of commercial rice seed must utilize modern production technologies, such as rice harvesters and moisture reduction technology, which can improve the efficiency of the seed production process (Palawisut, 2006). Also, suitable areas with good water sources are crucial for rice seed production. Rice seed producers should follow Good Agricultural Practices for Rice Seed (GAP seed) standards, which ensure that the seeds are produced using environmentally sustainable and socially responsible practices (Ministry of Agriculture and Cooperatives, 2017). Managing rice seed producer groups is also crucial in ensuring the seed production process is properly organized and efficient.

The investment required for seed production should also be considered throughout the process—the production from seed selection to selling the seeds to farmers.

### *Administrative Resources*

Administrative resources refer to the management factors that are essential for organizational success. These factors are known as the 7M's: Men, Money, Materials, Management or Method, Mark, Machine, and Morale (Kuptanon, 2008). The 7M's align with the principles of the POSDCoRB theory, which was developed by Luther H. Gulick and Lyndall Urwick (Gulick, 1937). The POSDCoRB management principle is helpful for managers to manage their organization or team effectively. By following these seven elements, managers can ensure that their team works efficiently and effectively toward achieving their goals and objectives: (1) The planning element helps managers to set clear direction and goals for their team, while; (2) The organizing element helps them to structure their team and allocate resources appropriately; (3) Staffing ensures that the team has the right people in the right roles, while; (4) Directing helps managers to provide guidance and oversight to ensure that tasks are completed successfully; (5) Coordinating ensures that all parts of the team work harmoniously, while; (6) Reporting helps keep everyone informed of progress and performance. Finally, and (7) Budgeting ensures that resources are used wisely and that the team is financially sustainable. The POSDCoRB management principle provides a comprehensive framework for managers to manage their teams effectively and efficiently. By following these principles, managers can improve their team's performance and achieve their goals and objectives (Chalekian, 2016).

### *Logistic Regression Analysis*

Logistic regression analysis examines the relationship between at least one dependent variable that consists of group variables with two groups or more and one or more independent variables. The dependent variable can be classified into two types based on the number of groups: (1) Binary logistic regression analysis, in which the dependent variable is a group variable with only two possible values (a dichotomous variable); and (2) Multinomial logistic regression analysis, in which the dependent variable is a group variable with more than two possible values (Vanichbuncha, 2018). For this research, binary logistic regression analysis was used, which involves one or more independent variables.

The logistic response function can be expressed as Equation (1).

$$\text{Prob}\{\text{event}\} = P\{Y = 1\} = \frac{e^{\beta_0 + \beta_1 X_1 + \dots + \beta_p X_p}}{1 + e^{\beta_0 + \beta_1 X_1 + \dots + \beta_p X_p}} \quad (1)$$

The relationship between the dependent and independent variables is not linear. Therefore, the relationship must be adjusted to be linear in the form of Odds that represent how often the likelihood of an event occurs and the Take Log Odds as Equations (2) and (3).

$$\text{Odds} = \frac{\text{Prob}(\text{event})}{\text{Prob}(\text{no event})} \quad (2)$$

$$\log(\text{Odds}) = \log \frac{\text{Prob}(\text{event})}{\text{Prob}(\text{no event})} \text{ or } \log(\text{Odds}) = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p \quad (3)$$

Where: Y is an approximation for estimation if  $\text{Prob}\{\text{event}\}$ , Equation (1) will be used for estimating the parameter using the Maximum Likelihood method.

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## **Methodology**

### *Population and Sampling*

The population was members of 35 community rice centers in Kamphaeng Phet Province, with 1,226 members. The researcher conducted purposive sampling with 13 community rice centers whose areas for planting rice seeds and good-quality rice consisted of 473 people, then randomly sampling and calculating the sample size according to the formula of Taro Yamane (Yamane, 1973) with 95 percent confidence. Therefore, the community rice centre members' sample size was 217 people.

### *Research Tools*

The tools used in this research include a structured interview form with closed-ended and open-ended questions. The interview style was tested for confidence by conducting a tryout with a group of farmers who share similar characteristics to the sample of 30 people. Cronbach's alpha coefficient was used to determine the confidence coefficient, which was 0.949, the consistency index of each question with the objective (Index of Item-Objective Congruence: IOC) using five experts was 0.865. Data collection took place between December 2022 and February 2023. The content of the interview consists of three parts: Part 1 Personal characteristics such as age, experience in rice seed production, and size of area for growing rice seed. Part 2 Production of

rice seeds, which includes cost, yield, price of rice seed production, source of selling, buying, and water for rice seed production. Part 3 Opinions of farmer members towards community rice centers management based on The POSDCoRB theory were used to guide the interview process, which includes planning, organizing, staffing, directing, coordinating, reporting, and budgeting. The opinions were divided into five levels using the Likert Scale: 5 Points: the management of the community rice center is excellent, 4 Points: the management of the community rice center is good, 3 Points: the management of the community rice center is fair, 2 Points: the management of community rice center needs to be improved, 1 Point: the management of community rice center urgently needs to be improved.

#### *Approval of Ethics by the Institutional Review Board (IRB)*

This study was endorsed for research project ethics considerations according to the ethical guidelines for research in people, that are international standards by the Human Research Ethics Committee Chiang Mai University, Thailand (Project ID: CMUREC No. 65/157).

#### *Data Analysis*

The researcher analyzed the collected data using descriptive statistics, including percentage, mean, and standard deviation, to explain personal characteristics and the production of rice seeds of community rice center members. Moreover, in the part analysis of members' opinions towards the management of the community rice center in all seven aspects, 49 questions were translated into five levels. The average score of 1.00–1.80 indicates that the community rice center's management level urgently needs to be improved, 1.81–2.60 indicates the

level of community rice center management needs to be improved, 2.61–3.40 indicates the management level of the community rice center is fair, 3.41–4.20 indicates the management level of the community rice center is good, 4.21–5.00, indicates the management level of the community rice center is excellent.

Binary logistic regression analysis was performed to predict factors influencing community rice centers' commercial rice seed production, assuming the dependent variable has two values, 0 and 1, where 1 is the commercial rice seed production, and 0 is non-commercial rice seed production. The six independent variables involved were the cost of rice seed production ( $x_1$ ), price of rice seed production ( $x_2$ ), the yield of rice seed ( $x_3$ ), source of selling for rice seed ( $x_4$ ), source of buying rice seed ( $x_5$ ), and management of community rice center to commercial rice seed production ( $x_6$ ) (Table 1).

## **Results**

### *Personal Characteristics of Farmer Members, Community Rice Center, Kamphaeng Phet Province, Thailand*

The study found that the community rice centers members who produced commercial rice seed had an average age of 51 years younger than those of the community rice centers who produced non-commercial rice average age of 55 years. However, the experience in rice seed production was more than average at 10.07 years and 7.69 years, respectively. In addition, the average area for growing rice seeds, more than those that produced non-commercial seed rice, was 37.92 rai and 27.50 rai, respectively (Table 2).

**Table 1** Description of possible factors in the study

Code	Description of Variables	Measurement scale
<b>Independent factor (<math>x_i</math>)</b>		
1. Cost ( $x_1$ )	Cost of rice seed production (baht)	Ratio scale
2. Price ( $x_2$ )	Price of rice seed production (baht)	Ratio scale
3. Production ( $x_3$ )	Yield of rice seed (kilogram)	Ratio scale
4. Source of selling ( $x_4$ )	Dummy: 1= CRC and RSC, 0 = mill	Nominal scale
5. Source of buying ( $x_5$ )	Dummy: 1= CRC and RSC, 0 = other	Nominal scale
6. Management ( $x_6$ )	Management of community rice center to commercial rice seed production	Interval scale
<b>Dependent Variable (Y)</b>		
Group of rice seed production	1 = Commercial rice seed production 0 = Non-commercial rice seed production	Nominal scale

**Table 2** Personal characteristics of commercial rice seed production and non-commercial rice seed production of community rice center members, Kamphaeng Phet Province, Thailand

Personal Characteristics	Commercial rice seed production ( <i>n</i> = 119)		Non-commercial rice seed production ( <i>n</i> = 98)	
	Mean	<i>SD</i>	Mean	<i>SD</i>
1. Age	50.63	12.42	55.06	8.65
2. Experience in rice seed production	10.07	7.61	7.69	7.09
3. Size of area for growing rice seed (rai)	37.92	31.63	27.50	16.29

Total cost of rice seed production (baht), was calculated by summing up all production expenses (e.g., soil preparation, seeds, planting, weed control, fertilizers, pest control, disease prevention, impurity, fuel, harvesting, and transportation) and dividing by the total size of area for growing rice seed (rai). The cost of commercially producing rice seeds averages 6,814 baht per rai, including various components expressed as percentages of the total cost. These components comprise soil preparation (7.28%), seed cost (6.64%), planting cost (17.06%), weed control cost (8.26%), fertilizer cost (13.46%), pest control and disease prevention cost (13.41%), impurity removal cost (14.28%), fuel cost (9.06%), harvesting cost (7.35%), and transportation cost (3.21%). When comparing commercial and non-commercial production, commercial production incurs higher costs in the parts of weedy rice (20.73%) and pest control (12.62%). In contrast, non-commercial production had an average cost of 5,692 baht per rai. This difference in costs suggests that the production of rice seeds by members of community rice centers engaging in commercial seed production entails higher total costs compared to those involved in non-commercial seed production. The additional costs include impurity removal cost, seed cost, planting cost, weed control cost, fertilizer cost, pest control, and disease prevention cost. On the other hand, the yield per rai was less than that of non-commercial rice seed production, with an average yield of 834.29 kilograms per rai and 899.90 kilograms per rai, respectively. The members of community rice centers who produced commercial rice seed need to grow rice seeds in the off-season or before to keep up with market demand. As a result, rice seeds must be

planted that do not correspond to the season of that rice variety, leading to a lower yield per rai compared to non-commercial rice seed producers who plant rice seeds according to the season of that rice seed. Nonetheless, price received per ton of rice seed (in baht), is determined by contractual agreements with buyers, or price make. Prices vary across farmers or samples based on location, quality of seeds, and sales channel (e.g., the Kamphaeng Phet Rice Seed Center, CRC, or private mills). The selling price of rice seeds for members who produce commercial rice seeds was higher than that for members who produce non-commercial rice seeds, with an average of 9,226 baht per ton and 7,973 baht per ton, respectively. This disparity can be attributed to the fact that members of community rice centers who produce seeds vend their yields to the Kamphaeng Phet Rice Seed Center. Community rice centers engaging in transactions with the Kamphaeng Phet Rice Seed Center are obligated to adhere to the policy set forth by the center. This policy dictates that the Kamphaeng Phet Rice Seed Center will repurchase the seeds at a price exceeding that of paddy sold at conventional mills (Table 3).

Regarding source of selling rice seeds, community rice center members who produce commercial rice seeds will have more distribution channels than community rice centers that produce non-commercial rice seeds. Table 4 shows that the source of selling rice seed was community rice centers, followed by others (mills/private companies), and rice seed centers were 59.66 percent, 54.62 percent, and 45.38 percent, respectively. Other community rice center members who produced non-commercial rice seeds mostly sold to mills, 94.08 percent.

**Table 3** Production of rice seeds of commercial rice seed production and non-commercial rice seed production farmer members, community rice center, Kamphaeng Phet Province, Thailand

Production of rice seeds	Commercial rice seed production ( <i>n</i> = 119)		Non-commercial rice seed production ( <i>n</i> = 98)	
	Mean	<i>SD</i>	Mean	<i>SD</i>
1. Cost of rice seed production (baht per rai)	6,814.22	946.41	5,692.24	917.28
2. The yield of rice seed (kilogram per rai)	834.29	103.39	899.90	144.38
3. Price of rice seed production (baht per ton)	9,226.05	967.91	7,973.47	464.08

**Table 4** Source of selling, buying, and water for rice seed production of commercial rice seed production and non-commercial rice seed production farmer members, community rice center, Kamphaeng Phet Province, Thailand

Production of rice seeds	Commercial rice seed production (n = 119)		Non-commercial rice seed production (n = 98)	
	Frequency	Percentage	Frequency	Percentage
Source of selling rice seed				
1. Rice Seed Center	54	45.38	0	0
2. Community Rice Center	71	59.66	6	5.88
3. Other (mills/companies)	65	54.62	96	94.08
Source of buying rice seed				
1. Rice Seed Center	84	99.96	37	36.26
2. Community Rice Center	40	47.60	21	20.58
3. Other (shops/ neighbors)	43	51.17	88	86.24
Source of water for rice seed production				
1. Groundwater	80	67.23	4	3.92
2. Irrigation canal	72	60.50	98	96.04

Regarding source of buying rice seeds, most community rice center members who produce commercial rice seeds buy rice seeds from rice seed centers, 99.96 percent. On the other hand, community rice center members who produced non-commercial rice seeds bought rice seeds from shops or neighbors, 86.24 percent.

The water source for rice seed production is considered an essential natural resource for growing rice seeds. Moreover, most community rice centers members who produce commercial rice seeds use water sources, namely, groundwater, that can be pumped to cultivate rice seeds throughout the planting season, 67.23 percent. On the other hand, most community rice center members who produced non-commercial rice seeds used irrigation canals and groundwater, 96.04 percent and 3.92 percent, respectively (Table 4).

#### *Comparison of Farm Members' Opinions toward Community Rice Center Management, Kamphaeng Phet Province, Thailand*

Opinions of community rice center members towards the managing of community rice centers that produced

commercial rice seeds indicate that overall, it was excellent level of management with = 4.33. When considering each aspect, it was found that planning, organizing, directing, and coordinating were excellent, with scores ranging from = 4.36, = 4.36, = 4.37, and = 4.31, respectively. Staff management received the highest score, with = 4.53. Reporting and budgeting were also rated highly, although slightly lower than the other aspects, with scores of = 4.18 and = 4.19, respectively (Table 5).

In comparison, opinions of community rice center members on the management of community rice centers that produce non-commercial rice seeds indicate an overall management level that is lower than the centers that produce commercial rice seeds, with = 3.91. When considering each aspect, it was found that planning, directing, and budgeting are at a good level, with scores ranging being = 3.48, = 4.04, and = 4.03, respectively. Staff management received the highest score, with = 4.26. Organizing, coordinating, and reporting were also rated positively, but slightly lower than the other aspects, with = 3.94, = 3.88, and = 3.76, respectively.

**Table 5** Comparison of farm members' opinions toward community rice center management, Kamphaeng Phet Province, Thailand

Community rice center management	Commercial rice seed production (n = 119)			Non-commercial rice seed production (n = 98)		
	Mean	SD	Interpretation	Mean	SD	Interpretation
Planning	4.36	0.50	excellent	3.48	0.78	good
Organizing	4.36	0.46	excellent	3.94	0.60	good
Staff	4.53	0.46	excellent	4.26	0.53	excellent
Directing	4.37	0.44	excellent	4.04	0.44	good
Coordinating	4.31	0.43	excellent	3.88	0.41	good
Reporting	4.18	0.58	good	3.76	0.60	good
Budgeting	4.19	0.61	good	4.03	0.73	good
Overall	4.33	0.42	excellent	3.91	0.50	good

Note: Opinion level toward community rice center management: mean 1.00–1.80 = urgently needs to be improved, mean 1.81–2.60 = needs to be improved, 2.61–3.40 = fair, 3.41–4.20 = good, 4.21–5.00 = excellent.

Community rice centers with commercial rice seed production had an overall management level higher than those producing non-commercial rice seed. The success of community rice centers depends on efficient management practices, including planning production, marketing, and finding channels for selling rice seeds, all with transparency and accountability. Since community rice centers are similar to small businesses that rely on management principles, these findings suggest that producing commercial rice seeds can lead to improved management practices and higher management among members.

### *Model of Factors Influencing Commercial Rice seed Production of Community Rice Centers*

#### *Examination of the relationship between independent and dependent variables*

To examine the relationship between independent and dependent variables, the Pearson Correlation Coefficient method was used to determine the correlation coefficient, which consisted of six related independent variables: cost of rice seed production ( $x_1$ ), price of rice seed production ( $x_2$ ), the yield of rice seed ( $x_3$ ), source of selling rice seed production ( $x_4$ ), source of buying rice seed production ( $x_5$ ), and an overall of community rice center management ( $x_6$ ) and dependent variables was rice seed production, where 1 = commercial rice seed production and 0 = non-commercial rice seed production. Most of the variables had a correlation coefficient not exceeding 0.50, which is considered a low correlation (Petchroj & Chamniprasat, 2012). The only independent variable with a correlation coefficient greater than 0.51 was the production cost of rice seed, which had a relationship with the price of rice seed yield equal to 0.52. Since the independent variable should not be related, a multicollinearity test was performed by considering the Variance Inflation Factor (VIF) and Tolerance. It was found that the independent

variables had a VIF between 1.17 and 1.63, which was less than 2.50, and a tolerance between 0.61 and 0.86, which is greater than 0.10. This indicates that the independent variables do not cause multicollinearity and excluding them is unnecessary (Habshah et al., 2010).

#### *Associated Statistic and Significance Test*

Logistic regression equations can be checked for suitability in several ways. The Omnibus Tests of Model Coefficients indicate how well the model performs compared to a model with none of the predictors entered. In this study, the chi-square value was 170.720, with a  $p$  value less than .05, suggesting that at least one factor influences the commercial rice seed production of the community rice center in Kamphaeng Phet Province (Table 6).

The Hosmer-Lemeshow Goodness of Fit Test can also test the model's suitability. So, to support the model, indicated by a significance value greater than .05. In this study, the chi-square value for the Hosmer-Lemeshow Test was 12.010, with a significance level of 1.51, indicating that the measurement model was consistent with the empirical data. This means that the appropriate logistic regression equation can be used to predict the likelihood of factors influencing the commercial rice seed production of the community rice center in Kamphaeng Phet Province.

Concordance between equations and data in logistic regression analysis can also be tested. In this study, the -2Log Likelihood (-2LL) was 128.070, and the Pseudo  $R^2$  value (Cox & Snell  $R^2$  squared value) was 0.545, indicating model consistency. Additionally, the Nagelkerke  $R^2$  squared value was 0.729, suggesting that the various independent variables efficiently forecasted the chance that the community rice center would produce commercial rice seeds with 72.90 percent accuracy. The forecasting model was also found to be 89.90 percent correct (Table 6).

**Table 6** Model of factors influencing commercial rice seed production of community rice centers

Independent Variables	$\beta$	SE	wald	$p$	Exp ( $\beta$ )
Cost of rice seed production	0.001	0.000	5.748	.017	1.001
Price of rice seed production	0.002	0.000	20.143	<.001	1.002
The yield of rice seed	-0.006	0.002	6.987	.008	0.994
Source of selling rice seed	1.858	0.598	9.534	.002	6.413
Source of buying rice seed	0.816	0.484	2.840	.092	2.261
Management	1.241	0.464	7.144	.008	3.460
Constant	-19.091	3.842	24.690	<.001	0.000

Omnibus Test of Model Coefficients: Model Chi-square = 170.720,  $p$  = < .001

Hosmer and Lemeshow's Test: Chi-square = 12.010,  $p$  = 1.51

Model Summary: -2Log likelihood = 128.070, Cox and Snell  $R$  Square = 0.545 (54.5%),

Nagelkerke  $R$  Square = 0.729 (72.90%)

Percentage Correct = 89.90

In summary, the results, based on the analysis of the relationship between independent variables and commercial rice seed production of community rice centers, suggest that several factors influence commercial rice seed production significantly ( $p$  value less than .05) and Wald Statistic value was more than 1, that means independent variable influencing to produce commercial rice seeds of community rice centers. These factors include the cost of rice seed production, the price of rice seed production, the yield of rice seed, the source of selling rice seed, and the management of the community rice center.

Specifically, the analysis found that the selling point of rice seeds and the management of the community rice center had the most significant influence on commercial rice seed production, with coefficients of 1.858 and 1.241, respectively. This suggests that the community rice center to produce commercial rice seeds will have various distribution channels, well-managed from planning to budgeting. The price of rice seed production also had a positive coefficient of 0.002, indicating that higher prices for rice seed can increase the likelihood of commercial rice seed production. On the other hand, the yield of rice seed had a negative coefficient of -0.006, suggesting that as the amount of rice seed production increases, the likelihood of commercial rice seed production decreases.

It is also important to note that the variable of where to purchase rice seeds had no significant effect on commercial rice seed production. The Equation presented,  $Z = -19.091 + 1.858(\text{Selling}) + 1.241(\text{Management}) + 0.002(\text{Price}) + 0.001(\text{Cost}) - 0.006(\text{Production})$ , can be used to understand the relationship between these variables and commercial rice seed production.

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## Discussion

The study analyzed the factors that influence the commercial rice seed production of community rice centers. The results suggest that several factors significantly affect commercial rice seed production. The key factors that impact commercial rice seed production are the cost, price, yield, source of selling, and management of the community rice center. The findings reveal that the source of selling rice seeds and the management of the community rice center have the most significant influence on commercial rice seed production. This is consistent with Darwis et al. (2021), who found that the source of selling by marketing network development is an opportunity to develop the rice seed business for farmers and is an economic goal

(Thamthanakoon et al., 2022). The CRCs has a market for rice seed production. Srisuantang, et al. (2011) said that developing a rice exhibition center can increase marketing channels for rice seed production system certification and the management of community rice centers that this study based on the POSDCoRB theory integrated with farmers, in line with Chongesiriroj and Bunchapatanasakda (2019) whose study was about opinion level on the management of occupational farmer groups at Chiang Rai province, Thailand used to improve management processes of occupational groups with participation to benefit and strengthen the group in the future. This is the same as Srisuantang et al. (2011) found, that there should be promotion of learning and solving the problem of rice production in the whole system between farmers and farmers' networks and related agencies to lead to sustainable development and create a process to upgrade the potential community rice center to be a prototype of the community rice seed center by allowing the community to participate and be able to manage the production of good quality rice seeds. It is also a source of knowledge about rice seed production technology.

Additionally, the price of rice seed production positively impacted commercial rice seed production, implying that higher prices can increase the likelihood of commercial rice seed production. Moreover, it is a channel to increase income for farmers who produce rice seeds (Palawisut, 2006). Although the production of rice seed has a high price, it also has a high cost, which is consistent with Tsourgiannis et al. (2008), Srisuantang et al. (2011), The research conducted by Hoque and Haque (2014) reveals that the profitability of rice seed production is influenced by various factors. Farm size emerges as a positive contributor, while age has a negative impact on profitability. Consequently, it is imperative to encourage the involvement of youth to middle-aged individuals in the sector.

To enhance the prospects of rice seed production, it is recommended to provide beneficiaries with education and knowledge related to rice seed production, establishing positive contributors. Additionally, measures should be taken to establish stronger connections between the Department of Agricultural Extension (DAE), research organizations, and farmers. This is consistent with Wongchai's (2019) choice of commercial rice production: Nanglue-Thachai Rice Seed Group in Chai Nat Province, research found that factors and conditions for the development of rice seed production in Nanglue-Thachai sub-districts were Geographic factors (space, soil feature, releasing water, abundance level, PH and area condition), technology factor and

knowledge transfer to the development of knowledge, skills and capabilities of rice farmer in the area, collaborative and government support (budgeting, machinery, the formation of community enterprises, marketing, and accounting). The economic and marketing factors in the cultivation and sale of rice seeds are important in the development of the group.

In summary, the success of commercial rice seed production is influenced by factors such as marketing channels, efficient management, pricing strategies, and collaboration between stakeholders. The study underscores the importance of addressing these factors to enhance the overall viability and sustainability of community rice centers in producing high-quality rice seeds.

## Conclusion

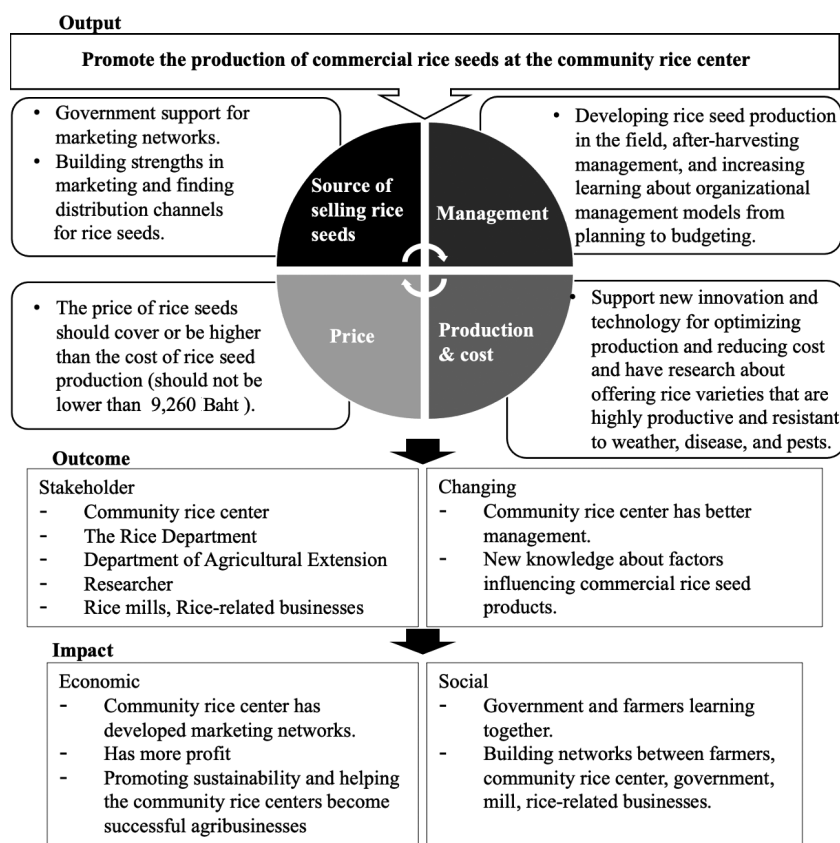
In conclusion, the study delves into the various factors influencing commercial rice seed production within community rice centers (CRCs). The findings underscore the pivotal role played by factors such as cost, price, yield, source of selling, and management of

CRCs. Notably, the source of selling and effective CRC management emerge as the most influential components, echoing previous research highlighting the significance of marketing networks and adept management in the success of commercial rice seed production.

The positive impact of pricing on commercial production, despite high associated costs, indicates a potential avenue for increasing income among farmers engaged in rice seed production. The profitability of this endeavor is affected by diverse factors, including farm size and the involvement of younger individuals, emphasizing the need for youth engagement to bolster the sector (Figure 1).

## Recommendations

1. Education and Knowledge Transfer: To enhance the prospects of rice seed production, it is recommended to implement educational programs aimed at providing beneficiaries with comprehensive knowledge related to rice seed production. This can include best practices, technological advancements, and efficient management strategies.



**Figure 1** Recommendation to promote the production of commercial rice seeds at the community rice centers

2. Strengthening Connections: Measures should be taken to establish stronger connections and collaboration between key stakeholders, such as the Department of Agricultural Extension, research organizations, and farmers. This collaborative effort can foster knowledge exchange, technological advancements, and streamlined processes within the rice seed production sector.

3. Youth Engagement: Recognizing the positive contribution of youth involvement, it is imperative to encourage and facilitate the participation of younger individuals in the rice seed production sector. This can be achieved through targeted programs, incentives, and initiatives that make the sector appealing to the younger generation.

4. Marketing Strategies: Given the significant impact of the source of selling on commercial rice seed production, there is a need to develop and enhance marketing strategies. This can involve the establishment and improvement of marketing networks, exploring innovative channels, and optimizing the overall marketing approach to increase the market reach for CRCs.

5. Government Support: Collaborative and supportive measures from the government, such as budgeting, provision of machinery, formation of community enterprises, and assistance with marketing and accounting, should be actively pursued. This can create an enabling environment for the development and sustainability of community rice centers.

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## Conflict of Interest

The authors declare that there is no conflict of interest.

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