Farmers' Adoption of Organic Rice Production in Chachoengsao Province, Thailand

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Abstract

This study analysed the factors affecting the adoption of organic rice production in Chachoengsao Province, Thailand. Primary data were collected through structured questionnaire completed by 108 farmers: (58 organic rice farmers and 50 non-organic rice farmers) in Chachoengsao Province, Thailand. A t-test was employed to investigate the differences in the demographics of organic and non-organic rice farmers, and percentage mean, and standard deviation was used to describe farmers' attitudes. Logistic regression was employed to investigate factors influencing organic rice adoption, educational level, and farm size were significantly different between the organic and non-organic rice farmers. Education (positive), farming experience (positive), age of household head (negative) and farm size (negative) had highly significant ($p \leq 0.01$) influences on organic farming adoption. The farmers' attitude toward environmental concern was the most important reason for adopting organic rice farming. This research identified the factors affecting the adoption of organic rice farming; this information can be used to encourage farmers to practice organic rice farming in the targeted organic rice area in Thailand. In addition, the farmers' attitudes toward organic farming systems could be used to help support farmers practicing organic rice farming.

Keywords: organic rice adoption, organic rice production, organic farming adoption, farmer attitudes.

Introduction

Consumers tend to consume organic products continuously, and this has become a global trend. In response to consumer demand, organic food products are quickly growing (Peng, 2019). All countries around the world report a trend of continual growth in the organic food and beverage market (Golijan & Dimitrijević, 2018). The demand for organic products has been reported to be increasing in both local and international markets (Declaro-Ruedas, 2019), and is expected to continue growing, especially in developed countries, while the supply of organic products is limited and still cannot produce enough organic products to meet the market demand. In Thailand, agricultural policy has addressed and promoted organic production and addressed the limited resources and economic and social conditions in communities to support sustainable agriculture (Office of Agricultural Economics, 2017). In addition, the National Organic Development Strategy 2017 to 2021 has achieved the goal of increasing the area used for organic farming and the number of organic products by no less than 20 percent per year. To achieve this target, the government is focusing on promoting and supporting research, development, and the dissemination of knowledge and innovations, including product development, in organic agriculture. Innovation in farm is a vital approach in sustainability strategy establishment in organic farming (Prasetyaningtyas et al., 2019). Chachoengsao Province is one of the eastern provinces in the central region that has organized the signing ceremony of the Memorandum of Cooperation for Organic Agriculture Development (Ministry of Agriculture, 2018).

Thai government encourages the expansion of the area used to grow organic products, in 2018, the total area of organic product continue increasing with growth rate 16 percent per year, however, representing only 0.41 of the country agricultural area, farmers produce few products, and they do not understand organic farming (Office of Agricultural Economics, 2018). This evidence indicates that most farmers in Thailand have not yet adopted organic farming. Research conducted on the factors affecting farmers' acceptance of organic farming provides critical information that can be used to encourage farmers to produce more organic products. Numerous studies have indicated that important factors of the decision to adopt organic farming include the amount of training provided; gender, which is the main determinant of organic rice farming adoption (Kerdsriserm et al., 2016); and farmers' attitudes towards farming influenced the growing of organic rice (Ashari et al., 2016).

This study identified factors explaining the adoption or non-adoption of organic rice farming. The case study area was Chachoengsao Province, which was listed as a target in the policy intended to increase the production of organic products in Thailand. Information on the farmers' demographics and factors affecting the adoption of organic rice farming is crucial for designing a suitable promotion programme to encourage farmers to participate in organic rice farming.

The specific objectives of this research were to: investigate the factors affecting the adoption of organic rice production and explain organic farmers' attitudes toward organic farming.

Methodology

This study identified factors affecting the adoption of organic rice farming in the four districts of Chachoengsao Province, Thailand (latitude, longitude 13°30′N 101°27″E): Sanam Chai Khet, Tha Takiap, Phanom Sarakham, and Bang Nam Priao. (Figure 1). A total of 108 respondents, 58 organic rice farmers in the Alternative Agriculture Network and 50 non-organic rice farmers, were selected using purposive sampling technique. The rice farmers were selected for this study by using geographical proximity criteria as described by Filippini et al. (2018).

Primary data were obtained by using a structured questionnaire to gather information on the farm size. The organic rice farmers' attitude toward organic rice production was measured by considering four aspects: production, economic, social, and environmental. The respondents were asked to agree or disagree with each statement using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree)

For the investigation of factors affecting farmers' adoption, the categorization of farmers into "adopters" and "non-adopters" is based on the dichotomous outcome of the adoption decision, which characterizes the dependent variable (Y). According to Ullah et al. (2015) binary logistic regression is most useful in cases where we want to model the event probability for a categorical response variable with two outcomes, it used to identify the factors affecting adoption of rice technology (Hagos et al., 2018). Okon and Idiong (2016) confirmed that logistic regression is an appropriate analytical tool to estimate the factors influencing adoption of organic agriculture.

In this study, the farmers' choices are represented by a dummy variable:

$$y = \begin{cases} 1 \ if \ organic \ rice \ farmer \\ 0 \ if \ non-organic \ rice \ farmer \end{cases}$$

The logistic regression for the adoption of organic farming can be expressed by following the methods of Ullah et al. (2015) as follows:

$$\ln[Pi/(1\text{-}Pi)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$$

where i represents the ith observation in the sample

P is the probability of the result, the probability that a farmer adopts organic rice farming is denoted as Pi, and the probability of the non-adoption of organic rice farming (or non-organic rice farmer) is 1-Pi

β_0 is the intercept term;

$\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 are the coefficients related to each independent variable;

X_1 = Age of household head (years);

X_2 = Educational attainment (years);

X_3 = Number of household members (head);

X_4 = Experience in rice farming (years); and

X_5 = Farm size (rai)

Results and Discussion

Demographic Characteristics

Demographics of organic and non-organic rice farmers are presented in Table 1. The organic rice farmers held less land for cultivation (approximately 16 rai) than nonorganic farmers (approximately 23 rai). In terms of rice farming experience, there was no significant difference between the organic and non-organic rice farmers.

Table 1: Mean demographics of organic and non-organic rice farmers

Variable	Organic rice (58 farmers)		Nonorganic rice (50 farmers)		t-value
	Mean	S.D.	Mean	S.D.	
Experience in rice farming (years)	32.52	13.41	32.62	14.02	0.969
Farm size (rai)	15.97	16.35	23.14	13.33	0.015**

** P ≤ 0.05., Note: 6.25 rai = 1 hectare

Factors Influencing the Adoption of Organic Rice Farming

The results of the binary logistic regression reveal the factors that significantly affect the adoption of organic rice farming are shown in Table 2. The results show that the Cox and Snell R^2 and Nagelkerke R^2 reflect pseudo-R-squares, has been used to explain the overall goodness of the binary logistic model (Abbas et al., 2017), which are 0.256 and 0.342, respectively. The outcome of the model indicates that the demographic variables included in this study account for 25.6 to 34.2 percent of the explanation for the adoption/non-adoption of organic rice farming.

Table 2: Factors affecting the adoption of organic rice

Variable	B	S.E.	Wald	Exp(B)
Age of household head (year)	-0.100***	0.037	7.306	0.905
Educational attainment (year)	1.005***	0.332	9.175	2.733
Number of household members (head)	0.289	0.322	0.806	1.335
Experience in rice farming (year)	0.087***	0.029	8.861	1.091
Farm size (rai)	-0.049***	0.016	10.127	0.952
Constant	0.497	2.026	0.060	1.644

-2 log likelihood is 117.153, Cox and Snell R Square is 0.256
Nagelkerke R Square is 0.342, Chi square statistic is 31.973***.
Overall correct prediction is 75%

*** P ≤ 0.01. B, parameter estimate; S.E., standard error.

The results reveal that educational attainment positively and statistically significantly affected the adoption of organic rice farming. The results for the odds ratio "Exp(B)" indicate that the decision to adopt organic rice farming is likely to increase by 2.733 times as the education level of the farmers' increases. The above results indicate

that farmers with more years of schooling are more willing to adopt organic farming. This finding is similar to the results of Azam (2015) and Digal and Placencia (2018), who found that educated farmers tend to adopt organic farming. There is minor evidence showing that education positively affects the adoption of organic farming (Azam & Banumathi, 2015), as well as trustworthiness and farm ownership (Rittinon & Uruyos, 2017). This could be because risk evaluation and adoption are knowledge-based, farmers with higher education were more likely to have a better knowledge of what exactly the term organic farming meant (Issa & Hamm, 2017).

Moreover, farmers who have more rice farming experience are 1.091 times more likely to adopt organic farming. This finding is similar to the results of Digal and Placencia (2018). It is reported that experience in farming make farmers more aware of the negative environmental and production effects of using chemicals for rice farming. Regarding soil nutrients, organic farms tend to better promote soil fertility and system stability than conventional farms (Husnain et al., 2017). Okon and Idiong (2016) revealed that farmers with more experience in rice farming are more likely to adopt organic rice farming practices. Knowledge openness is also seen to have positive effects on the decision to adopt organic farming (Rittinon & Uruyos, 2017).

The negative significance observed in the results for farm size indicates that farmers with smaller farms are more likely to adopt organic rice farming. The adoption of organic rice farming is likely to decrease the cultivation area by 0.952 times. This could be explained by the fact that smaller farms are more manageable and require less capital and less intensive labor than larger farms. This result is similar to the findings of Digal and Placencia (2018) which mentioned that promoters consider organic farming to be well-suited to smallholder farmer. However, contrary results were presented by Rittinon and Uruyos (2017) which revealed that farm size had positive effects on organic farming conversion. The results show that the age of the household head has a significantly negative relationship with the adoption of organic rice farming. The adoption of organic rice farming is likely to decrease by 0.905 times as farmers age. The results can be illustrated as well as the research of Shams et al. (2017) who pointed out that younger farmers have a better attitude for accepting organic farming as an innovation; thus, younger farmers are more interested in adopting organic farming.

Organic Farmers' Attitudes towards Organic Rice Production

The farmers' level of attitude toward the adoption of organic rice farming was measured and ranked in terms of four aspects. Table 3 summarizes the means of the factors for every four-aspect included in the study. Environmental concerns ranked first among the four identified aspects that influenced the farmers in Chachoengsao Province to adopt organic rice farming. Farmers see that organic farming does not harm the environment and strongly agree to its adoption. The economic aspects ranked second in terms of the level of attitude; the farmers see organic farming to be economical and viable. The level of attitude towards the production aspect and social aspect are of the same level, with mean scores of 3.7. The production of organic rice has potential in terms of being able to meet the land requirements, resistance to pests and diseases and the level of production. The

influence of society also plays a role in farmers' interest in adopting organic rice farming.

Table 3: Level of organic farmers' attitudes toward organic rice production

Item	Mean	S.D.
Environmental concern	**4.85***	**0.34**
Economic aspect	4.04	0.91
Production aspect	3.77	**.0**98
Social aspect	**3.76**	**0.81**
Grand mean	**4.23***	**0.70**

* = strongly agree

The production aspect influences the decision to adopt organic rice farming due to four factors (Table 4). The suitability of the land in Chachoengsao Province ranked highest in terms of the level of the attitude regarding the adoption of organic rice production. Farmers are more likely to adopt organic production if they have suitable land. When asked questions about pest and disease infestation in organic rice production, the farmers agreed that there is less infestation during production when using organic farming.

Furthermore, farmers indicated that practicing organic farming would make land tillage easier during land preparation. However, the farmer's perceptions of the yield per rai had a mean score of 2.9, and they moderately agreed that this aspect was important. A study conducted by Digal and Placencia (2018) on a province in the southern part of the Philippines shows that conventional to adopt organic farming because conventional farming will lead to a higher yield. Organic rice farmers acknowledged the challenge of the possibility of having a low yield; however, the potential of higher prices for organic produce could serve as remuneration for taking the risk.

Table 4: Production aspects that induced farmers to grow organic rice

Item	Mean	S.D.
Appropriate land condition that met organic agricultural standards for production.	4.17	0.68
Fewer diseases and insects.	4.03	0.79
Practicing organic farming would be made easier by land tillage.	3.93	0.81
High yield per rai.	2.95	1.63
Grand mean	**3.77**	**0.98**

The economic incentive of growing organic rice is one of the aspects which is considered by farmers practicing organic farming. The farmers strongly agree that guaranteed selling prices and reducing production costs for organic rice farming are factors affecting the decision to adopt organic rice farming. Digal and Placencia (2018) show the same findings that a lower production cost is associated with higher rates of adoption. However, the level of attitude of the farmers which is reported for items 3 to 5 (Table 5) indicates that they agree that these factors affect the decision

to adopt organic farming. The farmers are quite confident regarding the marketability of organic rice, and the adoption of organic farming likely increases the income of the farmers.

Table 5: Economic aspects that induced farmers to grow organic rice

Item	Mean	S.D.
Guaranteed buying price.	4.26*	0.85
Practicing organic farming would reduce production costs.	4.22*	0.94
Can sell directly to consumers	3.98	0.88
The selling price of organic rice is very good.	3.90	0.98
Practicing organic farming would be useful in terms of increasing income.	3.83	0.88
Grand mean	**4.04**	**0.91**

* = strongly agree

Farmers as members of society can be influenced to behave in certain ways. Table 6 outlines the level of attitude of farmers toward the social factors that induce farmers to grow rice organically. Encouragement from the family is considered by farmers to have the greatest influence, followed by the encouragement of fellow farmers. The success of neighboring farmers also influences the adoption of organic rice farming in Chachoengsao Province. A similar result was also mentioned by Issa and Hamm (2017), social concerns influenced farmers in their decision to adopt organic farming.

Table 6: Social aspects that induced farmers to grow organic rice

Item	Mean	S.D.
Encouragement from family members	4.22*	0.77
Encouragement from other farmers	3.67	0.85
Saw neighboring organic farmers' success	3.38	0.81
Grand mean	**3.76**	**0.81**

* = strongly agree

Regarding the environmental aspect, overall, the farmers indicated that they strongly agreed that all the factors affected the decision to adopt organic farming (Table 7). Organic farming is perceived to not harm the environment, and it is more likely that farmers will adopt organic farming of rice. This finding is consistent with the study of Ashari et al. (2018) who found that environmental concern were important determinants of adopting organic rice farming practices.

Table 7: Environmental aspects that induced farmers to grow organic rice

Item	Mean	S.D.
Organic rice production is not harmful to the soil and other organisms.	4.98*	0.13
Practicing organic farming can improve soil quality.	4.96*	0.26
Practicing organic farming benefits everyone.	4.94*	0.22
Organic rice production does not cause air pollution.	4.93*	0.32
Practicing organic farming can improve water quality.	4.91*	0.34
Practicing organic farming beneficially protect natural predators.	4.40*	0.77
Grand mean	**4.85**	**0.34**

* = strongly agree

Conclusion and Recommendations

Most educated farmers and more experienced farmers are more likely to adopt organic farming. Education and farming experience had a positive relationship with organic farming adoption. While the age of the household head and farm size had a significant negative influence on organic farming adoption. Farmers' attitudes toward environmental concerns were positive. The farmers were aware that organic farming does not harm the environment. This knowledge is critical for the government and related organizations in designing effective strategies for promoting organic rice farming in Chachoengsao Province and rural areas of Thailand.

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