No Better if Not Trustworthy: The Unreliability in Farmers' Agricultural Method

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Abstract
Adoption of agricultural technology results in a variety of positive outcomes for individuals and society, such as increased productivity, income maximization, cost reduction, environmental and health advantages. For several years, the Thai government has spent a lot of money on a campaign trying to persuade farmers to adopt organic practices. However, farmer adoption remains low. Recent academic literature had presented evidence that social learning and monetary subsidies are the major factors determining farmers' technology adoption decisions. In this study, a lab in the field experiments was observed 600 Thai farmers in rural areas with a simulated situation of farming between the conventional and organic rice practice to indicate the simulated process of farmers' adoption through the various types of motivations in order to guide the direction of Thai agriculture. Based on the results from the random-effects probit model, the social learning motivation, or role model motivations, can motivate farmers to adopt organic practices rather than farmers who were not motivated at all, notably when the role model has the same economic status as them. However, its efficacy tends to remain only in the short run and diminishes after that. Meanwhile, both cost and income subsidies also influence farmer adoption with a similar effect, unless the income subsidies are more likely to be sensitive to farmer decisions rather than cost subsidies in the long run.

Keywords: Adoption, Income Subsidy, Cost Subsidy, Social Learning, Role Model

1. Introduction

Organic rice practice produces more benefits in a variety of ways for both the commercial and public sectors as compared to conventional rice practice (Mendoza, 2004). However, adopting organic rice practice requires immediate upfront costs such as more labor, machinery, and organic fertilizer. It also takes a great amount of time, effort, as well as financial and economic resources to succeed. (Research Institute of Organic Agriculture, 2018). As a result, farmers' rates of adaptability are poor. Another factor that could be a major contributor to this low adoption of farmers is loss aversion (Liu, 2013; Osberghaus, 2017; Visser, Jumare, and Brick, 2019). Likewise, Xinjian Chen et al. (2018), stated that the main barriers of farmers' decisions are bearing the high cost and long payback period due to the concern of production risk and climate volatilities even though in the long run they can get more benefit from their farming if they quickly adapt to the cultivation method. In this sense, there is a behavioral bias between the theoretical logic and performance of agriculture work. For example, farmers may face the risk of losing yield, especially during the early period of converting from conventional to organic practice. Therefore, they may be unwilling to bear these up-front costs for an uncertain future gain, resulting in the low rate of adoption of organic rice practice, although the benefits of organic rice practice could outperform conventional ones in the long term.

One possible way to increase adoption would be to offer temporary conditional incentives on adopting organic rice practices. Theoretically, incentives should persuade farmers to adopt the new practice if they are large enough to reduce risk, particularly during the early stages of adoption (Ambler et al., 2020). In addition, the forms of incentives would also be important because people seem to respond differently to various forms of incentives even when the values of incentives are the same (Gneezy et al., 2011). In this study, we focus on two forms of widely used subsidies, which are the subsidy for production cost and income subsidy.

In addition, a form of agricultural role model was used to inspire farmers to adopt organic practice through a massive amount of government spending every year. The agricultural role models were supported by the government to distribute the agricultural knowledge and technology to other farmers around them. In other words, the influence of information diffusion through learning from farmer-to-farmer cloud impacts the adoption of organic rice practice. Bendura and Sehunk (1981) mentioned that social learning can substantially inspire the image of the future for people in society. Learning could be induced as farmers tend to learn more from their peer farmers than from community leaders or extension staff (Mobius and Rosenblat, 2014; Benyishay and Mobarak, 2019). Furthermore, there are anecdotal pieces of evidence suggesting that farmers may observe and imitate the decision of farmers who share similar conditions such as characteristics or skills, etc. that are comparable to the conditions facing them (Attvanich et al., 2019).

We conduct a lab-in-the-field experiment with rice farmers in the rural area of Thailand to test two potential strategies to mitigate this issue. Firstly, the potential strategies include social learning through different types of peer farmers, we divide the farmer into three groups according to their wealth: the same, lower, and higher endowment. Secondly, incentives are in two forms, cost, and income subsidies. Therefore, the design is to test whether we can improve organic rice adoption through social learning by involving farmers closer to various types of other farmers who are set as organic rice promoters and what subsidy form is more effective to induce more organic rice adoption.

2. Methodology

To answer the research questions, a lab-in-the-field experiment is designed to observe framers' decisions of choosing between two cultivation methods, conventional rice practice and organic rice practice. The experiment is conducted in rice farming communities in Khon Kaen, Buriram, and Surin provinces, which are located in the Northeast region of Thailand. In the experiment setting, the two cultivation methods have varied the cost and the return in different ways. The cost of cultivation and return of conventional rice are fixed for every round of the experiment, representing cropping seasons. The return is barely higher than the cost of cultivation to mimic the real situation of conventional rice where the price is low. Meanwhile, organic rice farming contains higher cultivation costs than the conventional one, and the return in the first three rounds of the experiment is set to be lower than the cost to imitate the actual practice for planting organic rice, which needs time to improve soil fertility during the early stage of adoption. After that, the yield will increase to almost the same as conventional rice resulting in higher profit as the higher price by the demand of high quality for organic rice.

Specifically, in the experiment setting, the cost of cultivation conventional rice is 6 Baht/Rai and the cost of growing organic rice is 8 Baht/Rai. The return of conventional practice is consistently assumed to be 8 Baht/Rai for all rounds (seasons). The return of the organic method, on the other hand, is 5 Baht/Rai in the first three rounds (seasons), which represents the low yield during the early transformation. However, the return of organic practice increases to 12 Baht/Rai in the fourth round onward representing an increase of yield after soil fertility is improved.

In addition to cost and return of cultivation, the 20 percent risk of losing some yields is assumed in both cultivation methods as uncontrollable damage such as drought and flood. Practically, when it occurs, the return of conventional practice drops from 8 Baht/Rai to 4.8 Baht/Rai, while the return of organic practice drops from 5 Baht/Rai to 1.5 Baht/Rai for the first three rounds (seasons) of adopting organic practice and from 12 Baht/Rai to 7.2 Baht/Rai since the fourth round (season) of continuously choosing this practice. Note that if there is any switching back from organic practice to conventional practice, the cost and the return of organic practice are reset. The experiment is set to ten rounds as ten seasonal croppings. In each round, participant farmers are asked to choose what practice they design to invest in. To motivate participants to seriously consider what practice they will choose in each round, the net profit that occurred in the experiment is exchanged for real money and paid to participants. Given ten rounds (seasons), without any interventions with the conditions of investment and return in the experiment, the rational participants are assumed to continuously choose conventional practice for all ten rounds to maximize the highest profit as the best strategy when compared to organic practice. Table 1 presents the net return of each method from rounds 1-10.

Table 1. The possibility of the highest payoff of the two methods.

Condition	Method I	Method II
1st -3rd		
Cost (Baht/ Rai)	6	8
Return (Baht/ Rai)	8	5
Highest payoff (Bath/ Rai)	+6	-9
4th -10th		
Cost (Baht/ Rai)	6	8
Return (Baht/ Rai)	8	12
Highest payoff (Bath/ Rai)	+14	+28
Total ten rounds (Bath/ Rai)	+20	+19

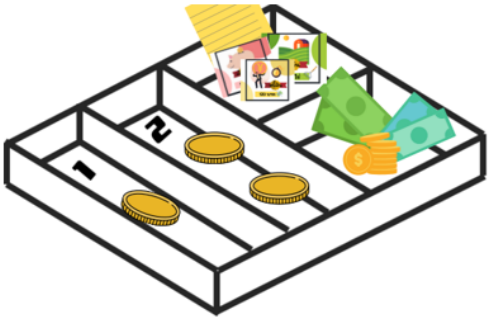
The implementation

The experiment was set up at the center of each village. Before the experiment started, participants are asked to answer a short questionnaire. After that, the experimenters start to encourage participants by introducing a scope of activities, then lead them to watch a video clip that explains the steps and process of investment of two practices in the experiment. The video clip consists of the conditions of investment, the cost and the return, and the payoff computation. Moreover, to diminish the misunderstanding, participants are allowed to play two example rounds to amend the process of investment in the experiment.

Initially, participants have endowments as a proxy of their economic status in the experiment consisting of lands, savings, and debt. To avoid copying answers, participants are asked to randomly select an equipment box by themselves, and no one knows other endowments in the boxes, although all the boxes have the same endowments. A box consists of a card of ten rai of land for planting (about 1.6 hectares), a card of 120 Baht for debt invoice, and 100 Baht in virtual money. Figure 1 provides the example picture of the box.

The experiment is run for ten rounds, in each round, after the experimenter announced a round number, the participants are asked to choose what practice between organic and conventional practices they are going to invest in for such round. The cost and return between two practices are always shown on the screen during the experiment to help them recall the cost and return of both practices before making a decision. Note that they cloud choose only one method and has to invest in all ten rai of lands in each round.

Figure 1. Example of an endowment box.



In each round, after participants have finished investment, the sub box is collected by our staff to easterly control for computing the return and to prevent cheating. The experimenter

then begins to bring a black box that contains 10 balls for participants to draw a ball. This step is to determine the effect of uncontrollable factors for losing some yield in each round. According to the probability of uncontrollable factors is 20 percent so the black box has two orange balls for the losing case and eight white balls for the neutral case.

As the consequence, the participants have 10 rai for planting rice, so the cost and the return are multiplied by 10. For conventional rice practice, the cost of investment per rai is 6 Baht while the return is 8 Baht/Rai in a neutral situation and is 4.8 Baht/Rai in losing a case, so the net payoff of each case is as follows:

- Neutral case: return (8*10)- cost (6*10) = 80 – 60 = 20 Baht.
- Losing case; return (4.8*10) – cost (6*10) = 48 - 60 = -12 Baht.

Meanwhile, for the organic practice, the cost is 8 Baht/Rai, and the return for the neutral situation is 5 Baht/Rai in the first three rounds and 12 Baht/Rai since the fourth round. Besides, in the losing case, the return drops from 5 Baht/Rai to 1.5 and from 12 Baht/Rai to 7.2 Baht/Rai respectively so the net payoff of each case is as follows

- Neutral case for first three rounds: return (5*10)- cost (8*10) = - 30 Baht.
- Neutral case for since fourth round: return (12*10)- cost (8*10) = 40 Baht.
- Losing case for first three rounds: return (1.5*10)- cost (8*10) = - 65 Baht.
- Losing case for since fourth round: return (7.2*10)- cost (8*10) = - 8 Baht.

Without any interventions, the best possible outcome for ten rounds is to continue choosing conventional rice practice, which provides a higher payoff than organic rice practice because the net highest payoff of conventional rice practice is 200 Baht (20*10), while the net highest payoff of organic rice practice is 190 Baht ((3*-30) + (7*40)). Hence, without any interventions, it would be more likely that the conventional practice would have a higher chance to be selected by participant farmers.

Interventions and extra conditions for the treatment groups

Cost and income subsidies

Two types of subsidies are used to motivate participants to organic practice. The first type of subsidy is cost subsidy. Whenever participants adopt organic practice within the first three rounds, they are compensated the cost for 5 Baht/rai so the compensation for the participants who choose organic practice since the first round is 15 Baht/rai, 10 Baht/rai for those who switch in the second round, and 5 Baht/rai for those who switch in the third round. There is no subsidy for those who switch to organic rice in the fourth round and onward.

The second type of subsidy is income subsidy. Instead of compensating cultivation cost, participants in this group are guaranteed to get an additional return of 5 Baht/Rai within the first three rounds, which is the same amount as the cost subsidy. Technically, farmers should decide in the same direction if they receive the same amount of subsidy. However, different forms of subsidies may differently affect decisions even the amounts of subsidies are the same especially if psychological effects on people's minds are different between these types of subsidies.

Role model information

To test the hypotheses, the different economic status of the role models is varied by the endowments, land, saving, and debt. Namely, there are three types of role model farmers who differ in the level of endowments, which are higher, lower endowments, and equal endowments compared to participant farmers. All types of role model farmers are designed to choose only the organic method and frame as the one who has the highest payoff from the experiment. The role model's endowments and decisions are shown to participants in every round before participants make decisions of what practice they will choose in such rounds.

Table 2. Details of interventions for each experimental group

Experimental group	Subsidy		Types of role model farmer		
	Cost	Income	Same endowment	Lower endowment	Higher endowment
C	-	-	-	-	-
T1	✓				
T2		✓			
T3			✓		
T4				✓	
T5					✓

3. Data and Estimation

Sample

Our participants were selected from two types of farmers which are conventional and organic rice farmers. The majority of our sample, therefore, is conventional rice farmers presents in table 3 which is categorized by provinces and types of farmers. Note that the randomization unit is at the village level where all participants in the same village are assigned to the same experimental group. We randomly assigned each village to one of the experimental groups stratified by province. Six hundred farmers were randomly separated into six experimental groups, an experimental group consisting of 10 subgroups, and each subgroup have 10 participants. From this number of participants, 440 farmers are practicing in the conventional method and 160 are farmers who are practicing in the organic method.

Table 3. Number of samples based on random assignment

Experimental group	Buriram		Khon Kaen		Surin		
	Conventional farmer	Organic farmer	Conventional farmer	Organic farmer	Conventional farmer	Organic farmer	Total
C	20	0	30	20	30	0	100
T1	10	20	20	10	10	30	100
T2	30	10	10	10	40	0	100
T3	20	0	20	20	20	20	100
T4	50	0	30	0	0	20	100
T5	40	0	30	0	30	0	100
Total	170	30	140	60	130	70	600

Empirical Strategy

To evaluate the impacts of interventions on organic rice practice adoption in the experiment, we estimate two sets of specifications using regressions at the participant level. Our first set of specification focuses on analyzing data from organic and conventional farmers. Since, the data obtained from the lab-in-the-field experiment has multilevel or clustered structure due to the longitudinal nature, an approach used to analyze such clustered data is the use of random effect regression analysis. Provided that the outcome variable in this study is a decision whether to adopt organic rice practice or conventional rice practice, the outcome variable is in a dichotomized manner or considered as a binary outcome. Thus, a random effect probit model is applied to estimate all model specifications described further. The first model of to this specification focuses on analyzing all treatments together. The model specification for this purpose can be presented as follows:

$$Dc_{it} = \alpha + \beta_3 PE_i + \beta_4 PL_i + \beta_5 PH_i + \beta_1 SC_i + \beta_2 SI_i + \gamma Rl_{it} + \mathbf{\beta X_i} + \varepsilon_i \quad (1)$$

where Dc_{it} is decision of a farmer i at round t.

It is equal 1 if a farmer selects organic rice practice and 0 otherwise. PE_i, PL_i, PH_i SC_i, and SI_i, represent dummy variables of information from role model farmer with the same endowments treatment, information from role model farmer with lower endowments treatment, and information from role model farmer with higher endowment treatment, subsidy cost treatment, and subsidy income treatment, respectively. Note that decision made by participants in control group is used as reference in estimation and this is applied to all specification explained below. Rl_{it} is a variable represented outcome of losing some yield of farmer i at round t. Rl_{it} is equal to1 if the orange ball is drawn meaning that farmers loss some yield in that round, and 0 otherwise. $\mathbf{X_i}$ is a vector of control variables represented farmers' characteristics and province alternative specific constant where Surin province is used as reference.

The second model of this specification highlights the short-run effects of information provided by different types of role model farmers. Since, the three types of role model farmers, same endowment as participants, lower endowment than participants, and higher endowment than participants, adopt organic rice practice in the first round of the experiment,

they take risk of losing income in the first three rounds (seasons). If participants adopt organic rice practice in one of the first three rounds of the experiment, it would suggest that information from role model farmers would strongly affect their decision. To analyze these impacts on enhancing organic rice adoption, we conduct an analysis only of those in role model farmer information treatments for the decision made in the first three rounds of the experiment. The model to test this question is presented below:

$$Dc_{it} = \alpha + \beta_3 PE_i + \beta_4 PL_i + \beta_5 PH_i + \gamma Rl_{it} + \mathbf{\beta X_i} + \varepsilon_i \quad (2)$$

where $t = 1, 2, 3$.

The third model of this specification focuses on the long-run effects of information provided by different types of role model farmers. To test clarify these effects, we analyze data from those in role model farmer information treatments for the decision made in round 4 to round 10 of the experiment. The model of this test is as follows:

$$Dc_{it} = \alpha + \beta_3 PE_i + \beta_4 PL_i + \beta_5 PH_i + \gamma Rl_{it} + \mathbf{\beta X_i} + \varepsilon_i \quad (3)$$

where $t = 4, 5, 6, \ldots, 10$.

The fourth model of this specification is to test whether the short-run effects of cost subsidy and income subsidy on enhancing organic rice adoption are different or not. To test the short-run effects of these forms of subsidies, we restrict our analysis for the decision made in the first three rounds of cost subsidy and income subsidy treatments as the subsidies are only available for the first three rounds of the experiment. The model specification to test the short-run effects of subsidies is as follow:

$$Dc_{it} = \alpha + \beta_1 SC_i + \beta_2 SI_i + \gamma Rl_{it} + \mathbf{\beta X_i} + \varepsilon_i \quad (4)$$

where $t = 1, 2, 3$.

The final model of this specification is to test whether the long-run effects of cost subsidy and income subsidy are different. After the third round of the experiment, both subsidies are not available anymore to farmers. Farmers may convert to conventional rice practice after the subsidies are ended especially those in subsidy cost treatment as the cost of practicing organic rice is higher than the conventional counterpart. To answer this question, the model specification is the same as equation 2 but the data used to estimate this effect is from round 4 to round 10 of both treatments where both subsidies are not available for farmers. The model specification for this test is as follows:

$$Dc_{it} = \alpha + \beta_1 SC_i + \beta_2 SI_i + \gamma Rl_{it} + \mathbf{\beta X_i} + \varepsilon_i \quad (5)$$

where $t = 4, 5, 6, \ldots, 10$.

4. Results

First, we present the estimation results from entire samples, which include both conventional and organic rice farmers. Table 4 presents the results from entire samples following model specifications 1 to 5. The full model column reveals the results of all interventions on farmers' decisions whether to adopt organic rice practice.

All of the interventions in our model were capable to persuade farmers decision to adopt the organic practice by the significant positive coefficient. The characteristics of role model farmers were separated into three types which are the role model farmers who have the same endowment, lower endowment, and higher endowment, the significant positive coefficient suggested that farmers in these treatments are more likely to adopt organic rice practice more than farmers in the control group (Coefficients are 3.39, 1.95 and 2.09, respectively, P-value < 0.01).

However, the sensitivity of different types of role model framers was tested to answer the impact of convincing by the different characteristics of role models. Interestingly, the coefficient testing stated that the impact of the information provided by role model farmers who share the same level of endowments as the participants is significantly larger than others for convincing participants to adopt organic rice, while the impact of information by the lower endowment and higher endowment are not different from each other (p-value = 0.595). as the result, given the information by role model farmers would increase organic rice adoption, especially for the role model farmers who share the same characteristics as them.

The next intervention is both types of subsidies, the cost and income subsidies also persuade farmer's decision to adopt organic rice practice with the positive significantly coefficients (3.22 for cost subsidy and 4.29 for income subsidy, p-value < 0.01) which means, farmers who are subsidized by cost and income are more likely to adopt organic practice than farmers who did not were subsidized.

The results also indicate that gender and age affect farmers' decision to adopt the organic practice. Male farmers seem unlikely to adopt organic farming compared to female farmers. While young farmers are going to adopt organic practices than old farmers. The farmers who practice organic rice farming in the real life are more likely to adopt the organic practice in the experiment rather than farmers who practice in conventional.

Short-run and long-run effects of different types of role model farmers

We also test the short-run and long-run effects of social influence to promote organic rice practice. This intervention is based on social learning from different types of role model farmers. Role model farmers act as communicators who provide information about how they made decisions on organic rice adoption. For our experiment, all types of role model farmers adopt organic rice in the first round of the experiment and continue to the end of the experiment. This means that they get negative returns since the experiment started, and will have chances to regain positive returns in rounds 4-10. If participant farmers use the information and follow advice from role model farmers, they should adopt the organic practice as early as them. To test this, we restrict our estimation for the short-run impact of information provided by role model farmers on organic rice adoption from rounds 1- 3 of the experiment. The results of this specification are presented in the column "Short-run effect of social learning". The results of the coefficient of the same, lower and higher endowments are 5.66, 3.84, and 4.41, respectively, which clearly show that first, the impacts of all types of role model farmers seem to be larger than what we have in the "The full model" indicating that in the short-run information provided by role model farmers would be able to advise farmers to adopt the organic practice. When we consider information provided from what type of role model farmers would be the most effective to convince farmers to adopt the organic practice, the result suggests that role model farmers with the same endowments as participant farmers are the ones whose information is the most effective to persuade

participant farmers to choose organic practice. The information provided by role model farmers with higher or lower endowments seems to have the same impact for enhancing organic adoption because the two coefficients are not statistically different from each other at a significant level of 0.31 (p-value > 0.10).

We also found similar results from the long-run effect of social learning, represented by column "Long-run effect of social learning" which shows the coefficient of the same, lower and higher endowments are 2.64, 1.43, and 1.71, respectively, on organic rice adoption. Information provided by role model farmers with the same endowments as participant farmers are still the most effective information to convince farmers to adopt the organic practice.

Table 4. Full data estimation results

Variables	Full model	Short-run effect of social learning	The long-run effect of social learning	Short-run effect of subsidies	The long-run effect o subsidies
Role model farmers					
Same endowment	3.390***	5.658***	2.644***		
	(0.000)	(0.000)	(0.000)		
Low endowment	1.952***	3.842***	1.434***		
	(0.000)	(0.000)	(0.000)		
High endowment	2.090***	4.414***	1.706***		
	(0.000)	(0.000)	(0.000)		
Subsidies					
Cost	3.221***			6.982***	3.171***
	(0.000)			(0.000)	(0.000)
Income	4.286***			7.878***	4.810***
	(0.000)			(0.000)	(0.000)
Orange ball	-0.167	0.169	-0.259	-0.445	-0.269
	(0.208)	(0.584)	(0.186)	(0.224)	(0.298)
Gender	-0.490***	-0.663	-0.199	-0.342	-0.015
	(0.005)	(0.125)	(0.296)	(0.496)	(0.953)
Age	-0.043***	-0.062***	-0.027***	-0.049**	-0.031**
	(0.000)	(0.004)	(0.004)	(0.043)	(0.014)
Organic farmer	1.949***	3.603***	1.871***	2.061***	1.669***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Size of land	-0.005	-0.026*	-0.013*	0.000	-0.009
	(0.441)	(0.087)	(0.086)	(0.990)	(0.367)
Ln(income)	-0.034	0.178	0.032	-0.640**	-0.589***
	(0.642)	(0.295)	(0.659)	(0.023)	(0.000)
Khon Kaen	-0.569***	-0.004	-0.072	-1.091*	-1.147***
	(0.006)	(0.994)	(0.731)	(0.065)	(0.000)
Buriram	1.207***	3.181***	2.422***	-0.712	-0.365
	(0.000)	(0.000)	(0.000)	(0.244)	(0.295)
Constant	2.738***	-0.443	0.631	9.344**	8.999***
	(0.008)	(0.862)	(0.555)	(0.012)	(0.000)
Log-likelihood	-783.260	-387.359	-371.871	-234.028	-227.439
Observation	6,000	1,200	2,800	900	2,100
Individual	600	400	400	300	300

Note: Numbers in parentheses are p-value. ***, **, and * are significant level at 1%, 5%, and 10%, respectively.

Short-run and long-run effects of cost and income subsidies

Next, we turn to the results of testing the short-run and long-run effects of subsidies. Column "Short-run effect of subsidies" presents the result of model specification (4) where data occurred in rounds 1-3 in the experiment is employed for estimation. This specification aims to answer whether the effects of cost subsidy and income subsidy are different in the first three rounds of the experiment where both subsidies are available to farmers who adopt organic rice practice. The results show that the coefficients of Cost and Income variables are 6.98 and 7.88, respectively which are positive and statistically significant and the size of both coefficients are statistically significantly *(p-value < 0.01*) larger than those in the Full model specification suggesting the impacts of both subsidies on convincing farmers to adopt organic practice are more intense in the short-run. We then test the size of the cost subsidy coefficient and income subsidy coefficient to check whether they are different from each other. Our test result indicates that even the coefficient of cost subsidy seems to be a bit smaller than that of income subsidy, they are not statistically different *(p-value > 0.10)* suggesting that both forms of subsidies provided the same effect for persuading farmers to adopt the organic practice in the short run.

We next move to the long-run effect of these subsidies where data from rounds 4-10 of the experiment are used. Note that starting from round 4 there are no subsidies for organic rice practice available for farmers anymore. However, farmers are still freely allowed to choose what types of practices, conventional and organic practices, they want to choose in each round. The results of this test are presented in the column "Long-run effect of subsidies". First, the results show that the effects of both forms of subsidies are reduced in the long run as their coefficients (3.17 for cost and 4.81 for income subsidy) are statistically significantly smaller than those of short-run effect *(p-value < 0.01*). We then test the coefficients of cost subsidy and income subsidy on organic adoption. The test result suggests that the coefficient of income subsidy is significantly larger than that of cost subsidy *(p-value < 0.05).*

5. Conclusions

The question of how to persuade farmers to adopt organic rice practice. Using a lab-in-the-field experiment, this study finds that temporary subsidies either cost subsidy or income subsidy would be able to increase adoption of organic rice before the point when they become privately profitable. When comparing the long-run effects of both subsidies, our results reveal that income subsidy would be more effective than cost subsidy. This is because the cost subsidy may create a psychological effect after it is removed as farmers treat instantly increase the cost of organic rice that they need to pay by themselves as a loss. To avoid this loss, it would be possible that some would convert back to conventional rice because its production cost is less than that of organic practice. On the other hand, farmers with income subsidies do not feel removing income subsidies is a loss because the return from organic rice practice is significantly higher than that of conventional practice after the subsidy is ended.

In addition, even though, we find that information provided by role model farmers is also important as it generally increases the adoption rate of organic rice, the information provided by what types of role model farmers is much more important. This point is interesting in which if we want to increase organic rice adoption through social learning, which may provide better cost-effectiveness than subsidy regime, the main focus should be highlighted on what type of farmers should be an early adopter or role model farmer who could make

their advice more credible to others. Our finding suggests that participant farmers seem to follow organic rice adoption advised by a role model farmer whose characteristics are the same or similar to them.

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